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INDEX TO FIFTH VOLUME.

Vol 5-6. July 1879 - June 1881

A

Art Castings in Steel, 14.
Aluminum Solder, 24.
A New Time Signal, 30, 31.
Antique Coin Jewellery, 82.
A New Night Timepiece, 100.
ssociation of Watch Manufacturers in Geneva, 103.
rtists and the Silver Trade, 119.
ntique Plate, 120.
nti-Oxide, 131.
wards of the International Exhibition at Sydney, 154.
rt Work in the Precious Metals, 156.
Few Words on Gems and Precious Stones, 158.

B

ook Notices, 6, 7, 101.
ronzes, 7, 34, 46, 58, 72, 130, 143.
ritish Horological Institute, 56.
itish Silver, 119.

C

orrespondence, 19, 24, 42, 45, 65, 70, 88, 89, 102, 104, 105, 130, 140, 152.
riosities of Clocks and Watches, 33, 48, 49, 60, 74.
lfont's Going Barrel and Stopwork, 57.
cks and Optical Goods, 68.
ock for the New Gas Works at Leicester, 84.
nch Pearls, 110.
ockmakers' Company's Prizes, 139.

D

Diamonds, 78, 79.

E

English Watch Company, 75, 85.
Excelsior Steam Works, 96.
lectric Time-Ball for India, 114, 115.
xhibition of Gold and Silver Work, Jewellery, Precious Stones, Clockwork, and of the Tools used in their Manufacture, 117.

F

Foreign Horological Literature, 71.
Finishing and Lacquering the Brass Surfaces of Timekeepers, etc., 86, 131, 143.

G

lasgow Goldsmiths' Company, 18, 19.
Greenwich Time-Ball, 28.
Gleanings, 40.
German Watchmakers' Society, 54.
Greenwich Chronometer Trials, 1879, 95.
Going Barrel versus Fusee, 97, 100.
Goldsmiths' Hall, London, 114.

H

Hints to Repairers, 9, 20, 35, 47, 61, 75, 92, 103, 116, 129, 141, 157.
Hall-marking, 10, 11.
Horology, 15, 16, 27, 28, 41, 42 55, 56, 69, 70, 83, 84.
Hall-marking Agitation in Dublin, 28.
Handsome piece of Goldsmiths' Work, 77.
Her Majesty's State Crown, 116, 117.
Hall-marks and Trade Marks, 152, 153.

I

Importations of Clocks and Watches, 14.
International Exhibition of Machinery and Tools at Geneva, 16, 17.
Important Sale of Jewels, 54.

J

Jewellery, 8, 31, 44, 45.
Jewellery Cases, &c., 73.
Jewellery in Relation to Art, 79.

M

More Antique Jewellery, 14.
Meeting of Manufacturing Jewellers at Birmingham, 17.
Molecular Oscillations, 32.
Messrs. Christofle and Co.'s Plating Works in Paris, 50.
More Swindle in the Watch Trade, 53.
"Multiple" Lathe, 140.
Monograms, 143, 144.
Manufacture of Antique Plate, 153.

N

New System of Musical Boxes, Orchestrions, &c., 4, 5.
New Weights and Measures' Act, 42.
New Designs in Gold and Silver Jewellery, 59.

O

On the Compensation of Clocks, Watches, and Chronometers, 5, 22, 24.
On the Demagnetisation of Watches, 76, 77.
Our Literature, 128.
Our Tools, 153.

P

Practical Instructions to Jewellers, Silversmiths, and Electro-platers, 3, 29, 43, 57, 71, 85, 101, 113, 127, 139, 151.
Polishing Aluminum, 19.
Precious Coral, 36, 37.
Permanent International Exhibition in Brussels, 102.
Prize Essay on Watch Tools, 112.
Pneumatic Clocks in Paris, 136.

Q

Queries and Answers, 49, 71, 84, 115, 130.

R

Report of the Select Committee on Hall-marking (Gold and Silver), 1, 2.

S

School for Jewellers, 49.

T

Trade Items, &c.: —

Nickel plating solution, Malleable nickel and cobalt, Elasticity of alloys, Purple enamel, Rose colour enamel, 6. Prices current for gold and silver, Prices charged for gold and silver, Bronzes and ivories, 9. New American patents, Rubies in France, New German tariff, 19. Discovery of Roman coins, 20. To give a golden colour to brass, Solution for cleaning brass chains, Phosphorescent powders, Importation of clocks and watches, Competition for going barrel and stopwork, 21. To blue small steel articles, To give cast-iron the appearance of bronze, Magnesium steel, Incombustible wood, Solution for electro-plating with copper, Japanese cement, Cutting and polishing stones, Importations of clocks and watches, 37. Glashutte School of Horology, Sweating sovereigns, 43. The first introduction of silver spoons, Finding of a nugget near Motygyme, 45. Presentation of a gold salver, Death of Herr Fritz Bähni of Bienne, 49. Bronze paint for iron or brass, Expansion of wrought iron and cast steel, Varnish for gilt articles, Holes in hard steel, Gold lettering on Glass, Varnish for polished metal, Simple construction of a Daniell cell, Robbery of £60,000 worth of diamonds, Resolution to float a diamond prospecting company, 51. The treasure chamber of the Sultans of Morocco, 54. Action of aqua regia on platinum, To remove the chalky appearance of silver after plating, Covering iron and steel with copper without a battery, Importation of clocks and watches during August, 1879, 59. A £100 prize awarded for an essay on the silversmiths' trade, The Sydney Exhibition, 61. The Japanese Government, A great discovery, The Paris Municipality, 64. Death of Mr. Thomas Bragg, of Birmingham, Emigration from Coventry, 65. Application of stress, Fusing metals without fire, 68. An extraordinary robbery, Technical education, A novel pair of opera glasses, Imitation diamonds, The jet industry of Cleveland, 70. The watchmaking industry of Neuchatel, Diamond Gipsy rings, 72. Use of petroleum in turning metals, To clean brass inlaid work, Improved electric amalgam, To cover articles with copper or brass by one immersion, The number of springs annually manufactured in Paris, International exhibition of watches, &c., Remarkable recovery of a lost diamond ring, 73. Discovery of sapphires in Siam, 74. Singular discovery during a sale by auction, An ingenious

diamond robbery, 77. An international exhibition, 86. To solder tortoiseshell, Polishing vulcanite, Silvering for barometer and thermometer scales, Uralium, a new metal, The galvanic oxidation of gold, 87. Price of rare metals, Goldsmiths' Company's prizes, 91. Parisian novelties, 92. The late Mr. John Hunt, 93. Watch trade in Switzerland, 100. A novel theory as to the origin of diamonds, 103. Precious metal trades in the United States, 105. Wages in France, Artificial onyx, 107, Sapphires, Failures in the jewellery watch trades, Diamond and pearl making, 109. Imitating emeralds, Anklets, 110. Hardening small tools, 113. Hawkers of watches outdone, 115. Electro-plate manufacturers, 118. Roman jewellery, Silver-plated ware on the continent, Permanent exhibition of watches, jewellery, &c., in Geneva, 119. Optometer, To remove nitrate of silver stains, Industrial art school in New York, Art exhibition at Amsterdam, 123. Truck system in the Coventry watch trade, 129. Sham gems, Queen Anne plate, Extensive diamond robbery at Cape Town, 132. Turner's cement, 133. The Albert chain, Victorian gold carbon from Brazil, Faraday's cap cement, City and Guilds of London Institute, 135. Small keyless watches, Gutta-percha cement, Novel mode of preserving a man's reason, 136. Tasmania and its tariff, Engraving machine, 138. Ivory, 139. A novel watch train, Caution, The French Crown jewels, British Silver Plate, 140. Pneumatic clocks, 143, 150. Great Jewellery Robbery at Carlisle, 148. Trade marks in Switzerland, Italian coral, 150. Report of the United States Consul, 151. Spurious watches, 153. Chloride of gold to free from an excess of acid, 155. Malleable bronzes, 157. Exportation of diamonds from the Cape, Material for protecting parts of an article not required to be gilt, 158. A very rare gem, 159. Enamelling on brass and German silver, Two tons of silver per week, 160.
The History of Gold War Medals, 11.
The Birmingham Jewellery Trade, 21, 32.
The Silver Duty and Hallmarking Question, 24.
The Report of the Goldsmiths' Company of Glasgow, 32.
The Prince Imperial's Watch, 39.
The International Watch Company, 42.
The Silver Trade, 45, 88, 102, 118, 128.
The Silver Trade and Hallmarking Question, 62, 64.
Technical Education, 64, 65, 93, 121, 134, 135, 147, 148, 160.
The End of a Fallacy, 84.
The Jewellery Trade in 1879, 90, 91.
The Manufacture of Diamonds, 92, 106, 107.
The French and Swiss Watch Trades, 107.
The Construction of a Simple but Mechanically Perfect Watch, 111, 112, 125, 126, 137, 138, 149, 150.
The Art of the Silversmith, 133, 159.
Two more Claimants for the Artificial Production of Diamonds, 115.
Table for Approximately Converting the English Decimal Ounce with the Continental Gramme Weights, 117.
The Pocket Rating of Watches, 138,
The Silver Trade with the Colonies, 140.
The New French Tariff, 141.
The Present System of the English Watch Manufacture, 144, 147.
The New India Museum, 156, 157.

W

Weights and Measures Act, 1878, 87.
Watchmakers' and Jewellers' Protection Society, 88, 89.
Watchmakers' Jewellers' and Silversmiths' Trade Society, 104, 105, 113.
Watchmakers' School at Glashutte (Saxony), 124.
Watch Trials in America, 132.
White Nickel Bronze, 136.

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Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

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CONTENTS.

	PAGE
Report of the Select Committee on Hall-marking (Gold and Silver)	1
Practical Instructions to Jewellers, Silversmiths and Electro-platers	3
New System of Musical Boxes, Orchestrions, &c.	4
On the Compensation of Clocks, Watches and Chronometers	5
Trade Recipes, &c.	6
Book Notice	6
Bronzes	7
Jewellery	8
Prices Current for Gold and Silver	8
Hints to Repairers	9
Bronzes and Ivories	9
Hall-marking	10
The History of Gold War Medals	11
Patents	12
Monthly Record of Bankruptcies	12
Art Castings in Steel	14
Importations of Clocks and Watches	14
More Antique Jewellery	14
Directory	ii
Advertisements	i-x

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REPORT OF THE SELECT COMMITTEE ON HALL-MARKING (GOLD AND SILVER).

THE following is the full text of this report:—

Your committee have examined numerous witnesses upon the matter referred to them; and the report of a Select Committee of this Honourable House which was appointed in the year 1856 "to enquire into the offices for assaying silver and gold wares in the United Kingdom," and the evidence taken by the committee, have been considered by them.

The inquiry before your committee was directed to three distinct topics; the first being the incidence and effect of the duties at present levied upon articles of gold and silver manufacture; the second, the effect of the existing system of compulsory assay and hall-harking; and the third, certain complaints against the operation of the present law.

It is in these days an accepted truism that every duty must operate as a fetter upon the manufacture on which it is imposed; to this the duties on gold and silver wares are no exception. It is true that the feeling of the trade is generally in favour of the retention of the duty. The close connection between the duty and the hall-marking system, has been prominently put forward as a reason why the tax is willingly borne by the trade. Probably, too, this feeling is, to some extent, due to an apprehension as to the effect of a remission of duty upon stocks in hand.

The evidence establishes that the manufacture of gold and silver plate in the United Kingdom is not growing. It seems rather to be declining. But your committee do not adopt the suggestion that this is entirely due to the duty. In England and Scotland duties were re-imposed (in place of licenses) in 1784, at the rate of 8s. per oz. on gold, and 6d. per oz. on silver. They continued at that rate till 1798, when the duty on gold was raised to 16s. per oz., and on silver to 1s. per oz. In 1805 the duty on silver was again raised to 1s. 3d. per oz. The present duty (17s. per oz. on gold, and 1s. 6d. per oz. on silver) was imposed in 1817. In Ireland, from 1730 down to 1806, the duty was 6d. per oz. on gold and silver alike, from 1807 till 1842 it was 1s. per oz. on gold and silver alike. Since 1842 it has been levied at the same rate as in England and Scotland. The returns of the amount of duty paid during these periods do not show that the successive increases of duty had so depressing an effect upon the manufacture as to preclude all growth. On the contrary, the maximum return (£123,128) was, in 1825, nine years after the imposition of the existing duty. For the year ending 1878 the total amount of the duty was £78,610 only. This decline is to some extent due to change in fashion; to some extent, also, to the durability of plate, which results in a large trade in second-hand silver, but in all probability is chiefly due to the development of the electro-plate manufacture, which seems to have become fully established in or about 1846, from which date a marked diminution in the yield of the plate duties is to be observed.

That the trade in gold and silver articles (as distinguished from the manufacture of plate) is not diminishing is suggested by the returns of the licenses granted to plate dealers; the proceeds of which have steadily increased from £16,898 8d. 6d. in the year ending 1846, to £42,216 15s. 9d. in the year ending 1878.

One evident objection to the duties on plate is to be found in the inequality of their incidence. The list of articles exempted from duty is long and apparently capricious. It seems to be based on no principle, except that of the necessity of collecting the duty by means of the assay offices, and consequently of exempting from duty all articles which cannot be assayed without "damaging, prejudicing, or defacing the same," or which are "too small to be safely marked." In consequence a large number of articles in common use, such as chains and bracelets, escape payment of the duty, not because their material is different from similar articles which are liable to duty, but simply because as the goods cannot be hall-marked the duty cannot be collected. Again electro-plate pays no duty, though it is evident that a large amount of silver bullion is used every year in this manufacture.

The imposition of a duty bearing so great a proportion to the intrinsic value of the raw material has a tendency to diminish the use of silver as an article of manufacture. Considering all the circumstances connected with this trade, and the importance of promoting the use of silver as an article of manufacture, your committee recommend the abolition of this duty, both customs and inland, whenever the condition of the revenue will permit.

To the principle of compulsorily assaying and marking articles of gold and silver manufacture there are no doubt some objections. It is possible that if the matter were new, and it were for the first time in contemplation to establish an assay under the control of Government, these objections might prevail. But in this country the system has existed substantially in its present form, since the reign of Edward I. Without speculating on its origin, and while making due allowances for its defects, it is established that it has resulted in the creation and maintenance of a high standard of excellence for all British assayed wares, which has not only raised the reputation of British workmanship at home and abroad, but has also created a large amount of private wealth readily convertible by reason of the guarantees of value which the hall-marks afford. As far as can be ascertained, most British manufacturers and by far the largest number of the dealers cling to the maintenance of the system with marked tenacity. The public do not complain of it. It also appears that foreign watch cases are sent to this country to be hall-marked in yearly increasing numbers. Nor should the antiquarian aspect of the question be altogether disregarded. At any rate this should prevail to the extent of throwing the burden of proof on those who propose the abolition of a system which has existed over 500 years.

Your committee do not consider that a voluntary or optional system of hall-marking would be satisfactory.

So long as the inland duty on plate is retained no better means of collecting it than through the assay authorities has been suggested. But your committee are of opinion the abolition of the duty need not entail the abolition of compulsory hall-marking. Watch-cases have been free from duty since 1798, but no difficulty has been experienced in enforcing the hall-marking laws with regard to them.

Assuming that the system of compulsory hall-marking, with or without the duty, is to be maintained, your committee proceed to consider the operation of the Acts under which that system is carried on.

Since the report of the committee of 1856 the assay office at York as ceased to exist. In other respects the condition of the offices described in that report seems to have continued unaltered.

The chief complaint against the operation of the existing law comes from the manufacturers of watches and watch-cases. They have established by evidence that within the last few years a practice has sprung up, and is rapidly increasing, under which foreign made watch cases are sent to this country to be hall-marked with the British hall-mark, and are afterwards fitted with foreign movements, and are then not unfrequently sold and dealt in as British made watches; and they assert that this not only injures their own reputation and lowers the credit of British workmanship, but is contrary to the spirit and intention of our legislation. The assay offices are unable legally to refuse to hall-mark these foreign watch-cases when brought for assay by registered dealers, though their officials are practically able to distinguish them from cases of British manufacture.

That Parliament has recognised the distinction between foreign and British plate is shown by the provisions of an Act, 30 and 31 Vic. c. 82, s. 24, which require all imported plate to be marked before sale with the letter F in an oval escutcheon, "in order to denote that such gold or silver plate was imported from foreign parts, and was not wrought or made in England, Scotland, or Ireland."

Until the practice of hall-marking foreign watch-cases sprang up, the British hall-marks were taken to indicate British workmanship, and your committee cannot doubt that foreign watches in watch-cases so hall-marked are frequently sold as of British manufacture.

Your committee are therefore of opinion that all foreign-made watch-cases assayed in this country ought to be impressed with an additional distinctive mark (the letter F, by reason of its resemblance to existing marks, is not sufficiently distinctive) indicative of foreign manufacture, and that the law ought to be altered accordingly.

Your committee are further of opinion that the Acts now in force require to be amended in regard to the following matters:—

(*a*) The assaying authorities should be allowed to return imported articles which are found below standard instead of breaking them up, as at present.

(*b*) A dome made of base metal should not exclude watch cases from being hall-marked.

(*c*) The assay authorities should have power to mark articles which, though standard, have enamel or other metals or substances added for purpose of ornament only.

(*d*) The lower standards of gold, viz., 15, 12, and 9 carats (equal respectively to 15 24th, 12 24th, and 9 24th of pure metal) should be discontinued. A composition containing less than two-thirds of pure metal ought not to be called by the name of that metal.

(*e*) The whole of the assay offices should be placed under the direct supervision of the Mint, so that uniform standard of quality shall be guaranteed.

(*f*) So long as a license duty is maintained it should be levied at a uniform rate.

It appears that in 1857 a Bill was prepared by the Commissioners of Inland Revenue for giving effect to the recommendation of the committee of 1856, that the Acts relating to the assaying of plate should be consolidated into one Act; but this Bill was never laid before Parliament. This is to be regretted. There seems to be considerable uncertainty in the application of the law in consequence of the number of statutes in which it is found, and your committee now express their opinion that the consolidation and amendment of the law should be carried out as proposed without further delay.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. IV.

(*Continued from page* 157.)

Cleansing Silver.—The processes for cleansing silver and the other metals, which follow, are not so perfect as those offered to us in the case of copper and its alloys. It is nearly always necessary to have recourse to mechanical agents, and as these cannot be applied to every part of the object simultaneously, it is impossible to completely prevent the action of the air, steam, gases and acid fumes. We shall, however, endeavour to indicate the most perfect and expeditious modes securing the best possible results.

To prepare silver for deposit it is absolutely necessary to free it from all impurities. To effect this, heat the object first to a dull red heat upon a slow fire. If the silver is pure, it becomes covered with a thin bluish film, the result of the combustion of animal or vegetable matter deposited on the object by handling; but if, as is generally the case, the silver is alloyed with a variable proportion of copper, the latter oxidizes, and the piece is covered with a greyish-black coating. While the article is still hot, plunge it into a boiling and well diluted solution of sulphuric acid; the object of this dipping is to dissolve the oxide of copper and to transform it into sulphate. If the heat has been sufficiently protracted for oxidizing all the copper on the surface, the object, when removed from the pickle, presents a perfect dead white. It is greyish, on the contrary, if the heat has not sufficiently acted, and the operation must be as many times repeated as are needed for a perfect lustre. This is what happens in the treatment of the lower qualities of silver ware.

Some gilders, instead of exposing the pieces to the fire direct, put them into sheet iron boxes filled with a mixture of powdered borax, chalk and coal dust. The borax serves the purpose of dissolving the oxide of copper as it is forming; but we cannot see the practical utility of the other two agents, unless they are intended to oppose the formation of a small quantity of oxide of silver, an object which the pickle would effect. They might, however, be useful in distributing a more uniform heat to every part of the work. Silversmiths employ this method in whitening and matting their wares.

If the objects to be cleaned are hollow, as, for instance, the medals formed of two shells, with their concave sides touching and soldered together round the rim it is indispensable, before applying heat, to make a small hole for the escape of the air expanded by the fire, otherwise the article is sure to burst and might injure the operator. This opening, indispensable in one sense, has also its inconvenience. When the article is dipped into the pickle, the latter naturally penetrates and occupies the space vacated by the air. It is by no means easy to remove it, and as it comes out it leaves yellowish spots on the parts it came in contact with. In order to prevent the spotting of the object by this liquor, it is dipped for a few minutes into a very dilute solution of ammonia or soda crystals, which prevents the action of the acid upon the silver. The article is then placed between layers of dry and warm fir-wood saw-dust, which will absorb the saline solution. Some operators prefer nitric, instead of sulphuric acid for their silver-cleaning pickle; in that case, the water must be distilled, and the acid free from chlorine or hydrochloric acid, otherwise the silver ware will be covered with a bluish white film of chloride of silver. It is necessary to observe that this method will not answer for articles in which iron or zinc may be present. In such cases, alkalies must be employed, and the articles afterwards polished with very fine sand or pumice-dust, with the aid of a stiff and short brush, or with a scratch brush alone. Perfectly cleansed silver may directly receive a metallic deposit, which will have the same clear lustre as the object itself. This circumstance is often taken advantage of to produce effective variations in tint on the surface of articles. It is, however, customary to scratch brush the articles before introducing them into the electro-plating bath.

Scratch Brushing.—This operation, which so often precedes and nearly always follows the manipulations with which we are occupied, deserves a special description. The object of scratch-brushing is to remove the dead lustre, or simply to clean the surface of an object by the frequently repeated friction of the points of many stiff and straight metallic wires called a scratch-brush or wire brush. Its shape varies with the articles to be operated upon. A hand scratch-brush is made of numerous wires, stiff and straight, taken from a bundle or coil of large diameter, so that the wires have little tendency to curve. For delicate objects, scratch-brushes are made of spun glass, the fibres of which are very thin and flexible. For making a good hand scratch-brush, select a bundle or coil of brass wire of the proper thickness, and wrap a good string tightly round it for about two-thirds of the intended length of the instrument, usually about eight inches. Then, with a cold chisel, cut the bundle of wire close to the string at one end, and at two inches from the other end of the string wrapping. Dip the end closed by the string into a neutral solution of chloride of zinc, and plunge into melted tin, which solders all the wires, thus preventing their separation while in use, and injury to the hand of the operator. The tool is then fixed to a thin wooden handle which projects above the soldered end. Very small scratch-brushes are necessary for reaching small holes and corners. An old scratch brush, the wires of which have been bent in every direction, and fixed to a long handle, is useful for rubbing the insides of certain pieces, such as Etruscan vases, coffee pots, &c. Scratch-brushing is seldom done dry, the tool and pieces must be constantly wetted with a stream of water, which carries away the impurities. Good metallic deposits become only polished by the friction of the scratch-brush, while bad ones scale off from the defective adhesion. The scratch-brush is, therefore, a sort of touchstone for metallic deposits. A large tub with a board placed across it, on which to rest the pieces, may be used; and various solutions are employed to assist the brushing, such as water and vinegar, or sour wine, or solutions of cream of tartar and alum, when it is desired to brighten a gold deposit which is too dark; but oftener a decoction of liquorice-root, horse-chestnut, marsh mallow, or bark of Panama wood, all of which produce an abundant scum, softening the friction of the scratch-brush. Every five or six days the old liquid is carefully decanted, so as not to carry away the deposits at the bottom, which always contain some of the precious metals, which are collected and recovered as will be shown hereafter.

For articles of jewellery and other small objects the scratch-brush is held like a writing pen, and a to and fro motion is imparted by the wrist only, the forearm resting on the edge of the tub. For larger articles of bronze, hold the fingers extended close to the forepart of the scratch-brush, so as to maintain the wires, and, with raised elbow, strike the piece repeatedly, with a sliding motion at the same time. When a hollow is met, which cannot be rubbed lengthways, a twisting motion is given to the tool, which occasions a longer friction on the same point.

(*To be continued.*)

NEW SYSTEM OF MUSICAL BOXES, ORCHESTRIONS, &c.

SOME time ago we alluded to a new and improved system of musical boxes, and we are now enabled to give a full description of the invention.

Everyone is familiar with the musical automatons hitherto in vogue, with their barrels and pins; and knows that the various notes are produced directly, as in the musical box, by the pins raising the sound-springs; or, indirectly, as in the case of the orchestrion, barrel organ, automatic pianofortes, etc., by tripping the tongues so as to admit the air current to the pipes, sound-springs or strings, according to the nature of the instrument. It is evident that the due performance of the instrument chiefly depends upon the proper action of the pinned barrel, and whoever has examined one of them will readily admit that its construction is by no means a short and easy task; in fact it forms the heaviest item in the cost of manufacture.

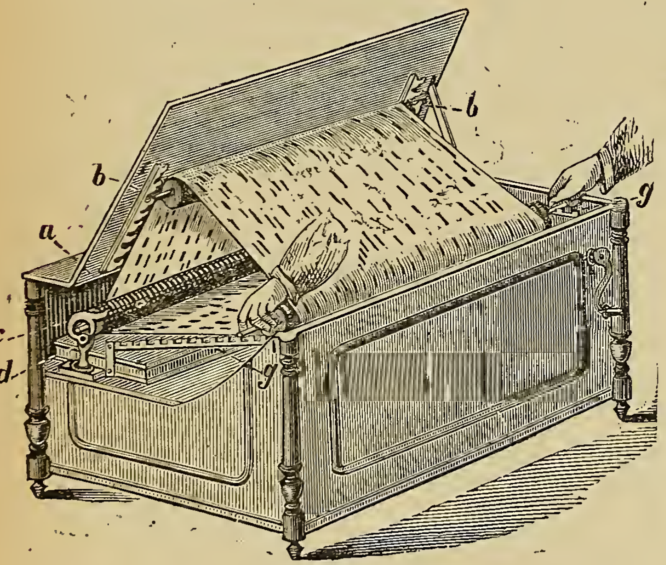

FIG. 1.

This system has, however, other drawbacks besides a comparatively costly construction. The change from one tune to another being effected by a sidewise movement of the barrel, the latter assumes already large dimensions if more than six airs are desired; necessitating of course also a proportionate extension of the other parts and a considerable increase in price. Again, the succession of tunes cannot be regulated at will in our ordinary musical boxes; if, for instance, the fifth air is wanted, we are obliged to listen to the four preceding ones first; the length of the pieces must also be considered in the selection, as a long operatic air would not combine with a short national melody, unless the former were abridged.

The new system we are now introducing is entirely free from these defects and enables the inventor, Mr. Paul Ehrlich, to manufacture a highly improved article at a much reduced cost. Anyone glancing at the annexed diagrams will at once perceive the great advantages of the innovation. In place of the usual "pinned" barrel, we have here a "grooved" one, *a*, resting in open supports, *d*, in which it is secured by movable clamps, *c*, this barrel has as many grooves as there are notes. The soul of the instrument is, however, the music-sheet, of thin but tenacious paper, and in which the notes are stamped out. As will be seen from the diagrams, one or two plain rollers, according to length of music-sheet, are employed in addition to the grooved barrel.

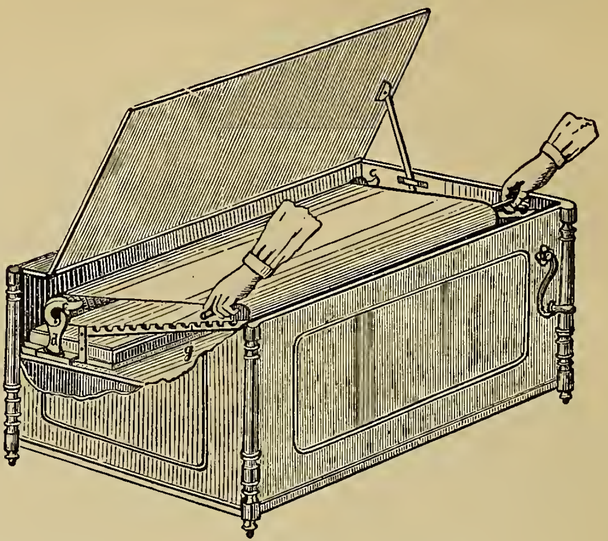

FIG. 2.

The sheet is thus gently stretched, and when the grooved barrel, which is in connection with the motor, is set revolving the sheet will unroll itself like an endless chain. The tongues are provided with pins, each of them corresponding with a groove in the barrel; they are held against the music-sheet by means of fine elastic springs, and in falling into their respective grooves, free the tongues and admit the air.

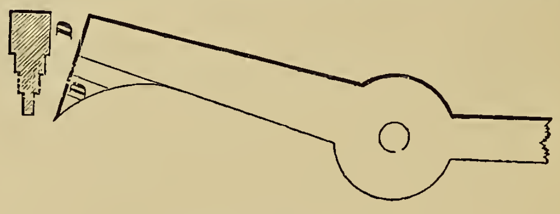

FIG. 3.

The preparation of the music sheet is most simple. The notes of the selected piece are transcribed on a piece of ordinary paper, the same size as the sheet to be used for the instrument; from this paper they are autographically transferred to the music-sheet, and the latter is finally passed under an ingeniously constructed stamping machine which cuts the notes out. The *crescendo* and *diminuendo* is obtained by a clever variation in the shape of the perforations, and the pins of the tongues have for the same end several corresponding gradations. According to the depth the pin enters, the tongue is more or less raised, and consequently the sound produced varies in duration and power. Any piece of music, whether short or long, can, therefore, be given by the same instrument, the music sheet alone having to be changed, an operation anyone can easily perform by following a few simple instructions. The price of these music-sheets, compared with the cost of the barrel of the usual musical box, is a mere trifle. We have now before us a list of some three hundred melodies, sheets of which the manufacturers keep in stock.

When a music sheet is to be set up, the grooved barrel is first passed through it, properly placed and fastened (one side of the sheet has a red border, and this side should be brought towards the snail). It is essential that the teeth of the snail fall into the winding of the screw as in Fig. 4; but if one of the teeth should rub against the screw as in Fig. 5, force must not be used, a slight turn of the handle will set it right. The smooth roller is then introduced and its ends deposited in one of the teeth of the combs, *g*, so as to keep the sheet moderately stretched. The shorter the piece, the nearer will, of course, the barrels approach each other. For very long pieces, another roller is similarly applied to the lid of the instrument as shown in Fig 1. To withdraw the music sheet, the order of the above operations is simply reversed. It is recommended to take the sheets out when the instrument is not in use, so as not to keep the lifting-springs uselessly in a state of tension. The sheets should not be exposed in too hot or damp places.

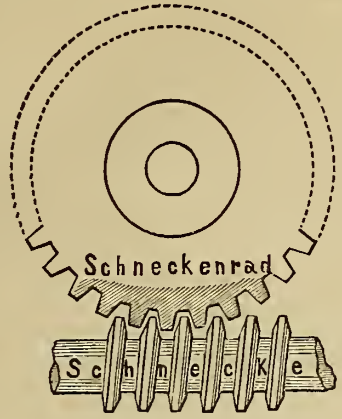

Fig. 4.

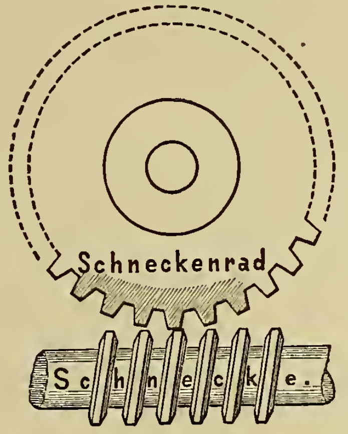

Fig. 5.

We may add that this important invention is patented all over Europe and America, and is meeting with the success it deserves. The factory of Messrs. P. Ehrlich and Co., of Gohlis, near Leipzig, has already assumed considerable proportions, giving employment to steam-power, and about eighty hands, although many of the auxiliary parts are drawn from outside.

ON THE COMPENSATION OF CLOCKS, WATCHES AND CHRONOMETERS.

By Edward Rigg, M.A.,
Assayer in the Royal Mint.

(Continued from page 165.)

The method adopted by Mr. Hartnup, of the Liverpool Observatory, for tabulating the errors of chronometers, and that of Lieussou, amount to a simplification of this method, and they have been found of the greatest service in practice.

Lieussou, in an elaborate paper describing observations on a large number of chronometers, concluded that if T be the mean between the two temperatures at which the chronometer is adjusted, and a the rate at this mean temperature, the rate, m, at any other temperature, t, may be represented by the formula:—

$$m = a + b\,x - c\,(T - t)_2$$

where x indicates the age of the oil in days, and b and c two constants that vary with different chronometers. In a good instrument he finds the several terms to have the values, $T = 15^\circ$ to 2°; $c = 0{\cdot}02''$ as a maximum; $b =$ not more than $0{\cdot}01''$ per day; a will, of course, depend on the rating of the chronometer. According to these figures, an instrument that is initially set to lose five seconds a-day at the temperature T, will, at the end of three years, gain this same amount. Lieussou's formula was modified by Pagol, but Villarceau maintains that both forms are incomplete. He points out that a theorem, known to mathematicians as Taylor's, offers the only complete method of expressing the rate of a chronometer under varying conditions, and this suggestion has been practically examined at sea by Lieut. De Magnac, with very satisfactory results, although the requisite calculations are extremely involved.

Hartnup's method differs materially from that of the French authorities, as his formula only contains one variable term, involving the square of the difference of temperature. Using Lieussou's symbols, the expression becomes

$$m = a + c\,(T - t)^2.$$

A method very generally adopted for diminishing the error of the ordinary balance consists in adjusting the spring so as not to be absolutely isochronous, but to occasion a slight gain in the short arcs, thus setting one source of error to counteract another. The instrument being adjusted at 15° and 30°, a fall below the lower point will occasion thickening of oil and therefore short arcs, when the accelerating effect of the spring will come into play. But any departure from true isochronism is by many regarded with suspicion, although Phillips, a high authority on the spiral spring, advocates the above practice.

The following are some of the typical modified forms of the circular balance:

First we may mention the invention of Le Roy, in 1766, which is a plain brass balance with uncut rim, and the compensation is entirely effected by the motion of the mercury in two glass thermometer tubes placed radially, the bulbs being filled with alcohol; this was the earliest form in which the motion took place in a straight line directed towards the centre. Another form is Molyneux's auxiliary, patented in 1840. When the strip in its inward motion reaches a certain position, it comes in contact with a second smaller weight, and the effective movement is thus a product of the motion of both weights; the adjustment being made for low temperatures is thus approximately correct for higher. In Poole's balance a similar result is secured by checking the movement outwards; the adjustment for this case must be made at the higher temperature. In Jacob's balance, a second small balance is fixed within the first, and banked so as only to act in heat; it can be rotated on the balance-staff, and thus, while the principle is nearly the same as that of Molyneux, it offers a greater range of adjustment.

Hutton and Breguet (J. H.) have patented arrangements for correcting the error in the primary compensation, by modifying the resistance opposed by the air to the movement of the balance, which is enclosed for this purpose in a confined space; but as no such method is ever employed in practice, it will suffice to merely refer to them.

A curious device is due to a Dutch chronometer-maker, Hohwü; and is theoretically preferable to those previously described.

(To be continued.)

TRADE RECIPES, &c.

(*Continued from page* 159.)

Nickel Plating Solution. — To a dilute solution of chloride of zinc, 5 to 10 per cent. nickel sulphate is to be added to impart a decidedly green colour to it, and the solution is then heated to boiling in a porcelain vessel. The clouding of the liquid from a separation of a basic zinc salt need not be heeded, as it will not interfere with the effectiveness of the bath.

The articles to be coated—first carefully cleaned of oxide or grease—are only suspended in the solution from thirty to sixty minutes, while no battery at all is required, only the bath must be kept at a boiling temperature. When the articles are uniformly coated, they are removed, washed in water in which a little chalk is suspended, dried and polished with chalk or other suitable material. This solution is guaranteed to give a coherent, consistent and tenacious coating.

Malleable Nickel and Cobalt. — Fleitmann has succeeded, by a very simple device, in obtaining cast nickel in a malleable and ductile form, even when cold, while cobalt prepared in the same manner possessed such hardness when cold, that he expects it can be used for cutting instruments, while hot it is both malleable and ductile. His process consists in adding to the fused metal, through a hole in the lid of the crucibles, ⅛ per cent. of metallic magnesium, which possesses a remarkable power of destroying carbonic oxide. The author is of the opinion that the porous and crystalline character of cast nickel is due to its absorption of carbonic oxide gas while in a molten state. It is not impossible, however, that owing to the great affinity of magnesium for nitrogen, its action may be due to the destruction of cyanogen in the metal.

Cobalt prepared in this manner possessed some of the reddish colour attributed to it in the text books; but actually excelled nickel in whiteness and brilliancy. He also welded these metals on to iron and steel at a white heat, and strips thus welded were rolled out to the finest number without separating from each other.—*Berichte d. d. Chem. Ges.*

Elasticity of Alloys.—M. Phillips reports some experiments for the determination of the coefficient of elasticity and of the limiting elasticity of different bodies. He refers especially to a new alloy which was melted and cast by Matthey, of London. Its density at the freezing point is 21·6139. Its composition is :—

Platinum	80·660
Iridium	19·079
Rhodium	·122
Iron...	·098
Ruthenium	·046
	100·005

This alloy is so malleable and ductile, that M. Sainte Claire Deville possesses a thread of it, which is only a few hundredths of a millimetre in diameter, and is scarcely visible. A hundredth of a millimetre is only $\frac{1}{2500}$ of an inch.—*Comptes Rendus.*

Purple Enamel.—4 parts gold in solution : 1 tin in solution. Procure a vessel to contain 50 parts of water about the temperature of blood-heat, to be well mixed with the solution of gold, and then add the solution of tin by dropping it into the menstruum, at the same time constantly stirring it with a strong feather, which will produce a fine purple colour liquor; but it will be necessary to add a few drops of silver solution, which will much assist to raise the colour and beauty of the purple ; to help the precipitation of the gold from its solvent (providing the precipitation does not immediately take place), add a large proportion of boiling water or a small quantity of sal ammoniac, and a precipitate will instantly be procured; the clear liquor must then be decanted off, and the boiling water repeated until it is completely insipid. The residue consists of the oxides of gold, tin and silver in combination, and is the only substance which has the property of communicating the purple colour to enamel glass. After the precipitate is prepared, the flux must be added, the proper quantity will solely depend on the fusibility or softness of the flux, and, as the operation in a great measure depends on observation, a few experiments by the operator will be found useful, independent of the accuracy of the receipt. To the purple precipitate may be added from 30 to 45 parts enamel flux, according to the strength of colour intended to be made.

Rose Colour Enamel.—3 dwts gold in solution, 60 leaves book silver, 2½ lbs. enamel flux. Procure a vessel to contain ten times the quantity of hot water, then mix the water and gold together while the water is at a temperature of 190° F. ; add pulverised sal ammoniac rather copiously, at the same time briskly stirring the mixture with a strong feather until the appearance of a decomposition takes place, which will soon be observable by the gold being precipitated from the menstruum in the form of a fine yellow powder ; when that is accomplished, let the vessel stand undisturbed a short time to allow the precipitate to subside, then decant the liquor off, and still add boiling water repeatedly to the precipitate until the water is perfectly insipid; and, in the next place, put it in a plaster bat to dry, after which, it must be mixed with book silver and flux, according to the proportions given above, and well triturated in a mortar; then send it to the mill to be ground, when it will be in a proper state for use. This colour is supposed to be best when of a purple tinge, which may be produced by merely calcining the preparation to the heat of ignition previous to being ground ; if the colour be too dark, the mixture does not possess a sufficient quantity of silver ; if it is too light, the silver must have been very plentifully added, therefore, the operator must add or diminish accordingly. Great caution must be observed with this receipt, as the gold precipitated by the sal ammoniac will unite with it, and then has the property of fulminating, and when gently heated or smartly struck with any hard instrument will immediately detonate; this can only be obviated by a plentiful use of boiling water, a caution which ought to be strictly attended to, as it removes the dangerous quality by depriving the gold of its salt.

(*To be continued.*)

BOOK NOTICE.

L'ART DE LA BIJOUTERIE. P. Barousse, Paris.—It is universally recognized that the French, with few exceptions, rule supreme in the industrial arts, a position to which last year's Exhibition showed them again justly entitled. Whoever has attended that magnificent industrial tournament must have been struck with the great resources of French art and industry. One would naturally associate such a vitality and degree of perfection with a land having enjoyed a long period of peace and plenty; but we all know that such a happy state of things did not exist in France during the years immediately preceding the Exhibition; on the contrary, an unfortunate war, the overthrow of a dynasty, and furious party strife and excesses had ravaged the country—elements which would have completely paralysed any other nation.

It may well be asked, How has France gained and maintained its enviable position ? The solution is to be found in the high class and widely spread technical and art education.

The French artificer has enjoyed the benefit of such invaluable institutions as the South Kensington Museum and its allied schools, &c., for generations; in fact, art industry has been under liberal state patronage in their country for more than two centuries. Richelieu, Mazarin and Colbert, in the 16th and 17th centuries, had already recognised the arts and sciences as immense powers for refinement and wealth, and they gave them their influential support.

Towards the middle of the last century, France could already boast of forty-seven provincial schools of design, &c., in connection with the five extensive institutes of Paris. The Royal School of Design in Paris alone counted 1,500 pupils. Change of dynasty, of form of government, of economic and social relations, had, of course, their influence on the development of this grand national scheme, but it varied only in intensity, it was never abandoned altogether. If it had languished for awhile, it would ere long regain new vigour, and make up for lost time. Men distinguished in their special callings were not only consulted, but put at the head of richly-endowed institutes. It is ascertained that France spent twenty-one milliards of francs, up to the time of the Revolution, for spreading and popularizing the arts and sciences. No one can now deny that this plentiful seed has resulted in a rich harvest, which enabled France to pay the war indemnity of eight milliards with such alacrity.

It must, therefore, not be forgotten that this superiority of the French as regards taste and technical skill, has only been attained by careful training, industry, perseverance, and judicious state aid. All these requirements are now also at the disposal of the British art-worker, and if he only makes good use of them he will not be long in coming to the front. Technical and art education has rapidly spread in this country within the last few years, and the laudable efforts of the Science and Art Department are making themselves already felt.

That there is plenty of room for improvement in our precious metal-work no one will deny. We do not lack able jewellers and silversmiths, and their execution and finish stands comparison well, but such skill is only lost on tasteless and unnatural forms. A large plain surface, however well polished, and however rich its lustre, is not artistic. Designers say, and we believe with truth, that they cannot get paid for real good work. Again, we have been told by an art jeweller that if he buys a good design he cannot get a workman to make it up creditably; but this statement we do not endorse ourselves, as we are personally acquainted with men who can do justice to any design, and who would only be too glad to leave off making ugly things. Some of the present productions of Birmingham are disgraceful, and it is no excuse to say that they are made by machinery and must be so very cheap. It is simply perpetuating the vulgar taste of the common crowd. Articles can be made cheap without being monstrous, all that is required is a good model, and the stamping machine will do its work with the same ease and at the same cost. Mr. W. Bragge, while speaking on "Machinery in its relation to Art Productions," at the Sheffield School of Art, truly said that the "machine is as willing to work for the Spirit of Beauty as for the Demon of Ugliness."

We have now before us the first five parts of a magnificent monthly publication of origiual designs (designs only), specially prepared for jewellers, silversmiths, enamellers, and engravers, &c., and which we earnestly recommend to all those who are anxious to contribute something towards securing those crafts a worthier place among our industrial arts. The designs are by the best Parisian designers in these branches and beautifully executed in proper colours. In the hands of a man of taste they will prove highly productive. For terms of publication, &c., we refer to our advertising columns.

BRONZES.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 161.)

THE method of forming in *rilievo* by embossing or beating up in mould and finishing with the punch and chaser, work known as *emblemata*, is also of a like antiquity. Both processes were well known to the Egyptians; an example of beaten work is a small figure of Osiris in the British Museum. Hollow casts, in which the solid interior was supplanted by an earthy core, a method by which great lightness and economy of metal were secured, were made by the Egyptians, even in figures of a smaller size. An example in the writer's collection is still filled with a black core, very light, which seems to be composed of sand with powdered charcoal and probably some agglutinating substance; but it is of a later period than the sixth century before Christ.

To Glaucus of Chios was ascribed the art of soldering the various pieces together, thus obviating the necessity for rivets. Mythical statements of this kind must, however, be received with full allowance for poetical sentiment, and the desire to attach discovery or improvement to individual names. They can, moreover, only refer to the use of bronze in the sculptor's studio; the bronze weapons of prehistoric times having been known to the classic writers, and collected and highly prized as curiosities by some of the Roman emperors.

We have thrown a hasty and somewhat general glance upon the early modes of fabrication of bronze and copper, and the uses to which they were applied in prehistoric ages. The objects of necessity must naturally have been implements for the chase, weapons of defence, and tools. Ornaments for personal adornment were only secondary, but soon the desire to imitate the forms of surrounding natural objects, and to create and embody types of a religious sentiment, inspired by the common observation of natural phenomena, led to the production of rough figures in terra-cotta, wood, and other simple materials, which were followed by similar works in bronze.

At what precise period those curious rude figures which have been found in various parts of the Italian central and southern hill country may have been made, and under what circumstances of civilisation, is more than antiquarian knowledge can, as yet, define; nor do we feel called upon in a work of this nature to do more than allude to that abstruse subject of high antiquity which has occupied the thoughts and pens of many antiquaries. But although it may be reasonable to conclude that smaller objects, such as those just referred to, were for the most part, even in the earlier ages of civilisation, formed by fusing and casting in the mould, the desire to make works of larger size or more intricate form was beyond the means at their disposal; nor were the primitive artists sufficiently cunning to devise mechanical methods for the production of a more complete cast. We find accordingly, in the Greek and Mediterranean islands and mainland, and particularly in Etruria and other provinces of Italy, existing examples, which show that those simple tools, the hammer and the tongs, were called into service to produce beaten metal-work in copper and its alloys: plates were hammered and adjusted in the form of the different limbs of the required figure, then finished by chasing or punching, and fixed or rivetted to each other, or fastened by pinning upon a wooden shape.

(*To be continued.*)

JEWELLERY.

By George Wallis.

(*Continued from page* 144.)

In this we have an illustration, so far, of mechanically-made jewellery in its nearest approach to hand work. All the fitting has to be done by a skilled workman. The trained eye and dexterous manipulation are here, but the artistic production of the ornament details is due to the die and the dexterity with which the *repoussé* operation is performed by the workman. The result is an absolute repetition to any extent of the same pattern in every detail or object required. Brooches, bracelets, lockets, &c., are produced by processes like that described, the dies being adapted to the detail required, and its position in or on the object to be executed. Still the taste, skill, and dexterity in mounting these details, and fitting them with all due accuracy into their proper positions, as also the final finish of the article, are due to the skilled workman.

Ring-making is as separate a branch of the jewellery trade as chain-making. In the production of foreign rings in numbers of the same patterns, press work is largely used, the shapes being stamped by means of a stamping-press, and afterwards pressed into suitable dies, much after the manner of striking a medal. Of course the preparation for setting rings with stones, &c., is largely done by hand, and the rings themselves are finished with more or less skill and minuteness, according to quality and price. High class work in finger rings is, however, done entirely by hand, and the skill, taste, and artistic perception displayed by some ring-makers are worthy of all praise. This is especially the case with the makers of ladies' rings, which is a separate branch of production from that of gentlemen's or signet rings. These latter are usually of a more massive character, requiring a totally different treatment to those made specially for ladies' wear.

So far, then, whatever of mechanical appliances the exigencies of modern manufacture have brought to bear upon the production of jewellery, in order to cheapen the labour of repetition and meet increasing demands, very much is still left to hand-work and the skill of the trained artisan, and machinery in its proper and distinct application cannot be said to play any very important part. This also may be said to apply to a considerable extent to plated jewellery, which is the best kind of imitation work. In this class of production the workmanship is altogether similar in character to that of gold or real work, the difference consisting in the fact that in plated work a film of gold covers and is mechanically incorporated with the base metal which forms the real structure of the work. The design, finish, and appearance are essentially the same as in gold work.

The application of machinery in its most legitimate and scientific form is to the production of chains of various qualities and kinds—gold, silver, and base metal.

In the repetition of links, the twisting and continuous convolution of wire of varied form, machinery of most ingenious construction plays an important part, cheapening production, securing strength and flexibility, as well as beauty and uniformity, until we arrive at the manufacture of a serpent or snake chain, in which the metal is at once so attenuated, and yet possesses all requisite strength, that it can be produced in common metal at 4s. 6d. per yard, wholesale. This, however, is the production of one manufacturer, who keeps his own secret, which no one has at present been able to unravel.

In addition to gold work, plated and gilt jewellery, a very large quantity of silver jewellery is made at Birmingham, and indeed most, if not all, of the so-called Scotch jewellery, consisting of brooches of various sizes and kinds, shawl and plaid pins, elaborately engraved, and sometimes enamelled and set with Cairngarm gems and variegated pebbles, is of Birmingham manufacture. The production of silver work is kept quite as distinct from the other branches, and in no instance that I am aware of are any two branches carried on by the same firm. About twenty years ago an effort was made in Birmingham to introduce, or rather revive, the production of silver filigree work as applied to various articles of personal decoration, and although some good work was done the effort failed, and I believe that nothing of the kind is now done in England. Yet filigree presents a wide field of application in which female labour and skill could be largely employed. The manipulation of a delicate wire, either in silver or gold, into decorative forms, is a light and elegant kind of work, in which taste and ingenuity would have great scope. Possibly some turn of fashion may ere long bring it into demand; at present the filigree jewellery sold in England is of foreign production, chiefly Swiss and Italian.

The lower class of both silver and imitation jewellery is largely produced by machinery adapted to the exigencies of each particular branch. Take the lowest of all, for example, as giving a full illustration. A brooch or a locket has to be produced, probably by the gross. The design being settled, and the mode of fitting the parts together so as to avoid hand work as much as possible, steel dies are sunk, not for use by hand, as in the instance already quoted, but for use in a stamping-press. In addition to the die, a "force," as it is called, is also wrought by the die sinker; this fits into the die, simply allowing for the thickness of the metal which is to be mechanically pressed, or forced into it, to give it not only the requisite general shape, but every detail of ornamentation which the die sinker has executed in intaglio in the die. The front of a brooch, sides of ear-drops *en suite*, &c., are stamped at a rapid rate in copper, or some suitable alloy; the two sides of a locket, with provision for hingeing and fastening, are produced in the same way, and so on throughout every kind of article which it pays the manufacturer to imitate and send into the market.

It is necessary, however, to explain that although portions of an object having details in comparatively low relief may be stamped in the shell, so to speak, at once, yet when the relief is high this can only be done at two or three operations, the metal being annealed by fire between each process of stamping, as in the instance already quoted of the hand-wrought die, to prevent the splitting of the metal.

The finish of these articles is as rapid as their production. As they have to be gilt, science comes in when mechanism leaves them, and after pickling in a hot alkaline solution to remove the effects of the fire, they are immersed in the gold bath of the electro-gilder, and are quickly covered with a film of gold of greater or less density according to price. Of the attenuated character of some of this gilding, an idea may be formed from the fact that a gross of buttons is sometimes covered with three pennyweights of gold. The finish beyond this amounts to no more than giving them a shake, when dry, in a bag of bran.

(*To be continued.*)

Prices Current for Gold and Silver.—Value given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver 4s. 6½d. to 4s. 9d. (variable according to quantity).

HINTS TO REPAIRERS.

(Continued from page 160.)

HAVING satisfied yourself as to the end-shake of the fuzee, you will then bush the lower hole. Of course you will have fitted the fuzee pivot to its hole by broaching it out slightly (as it was bored nearly large enough), and then polishing the hole with a round broach, which not only polishes the hole, but hardens its surface. Remove the fuzee bridge and broach out the hole, file up a piece of wire to fit it, cut it off a little longer than the hole, and rivet it well in, being careful not to deface the bridge; screw it back again, and put the plates together. Sometimes it is as well to bush the upper hole in the same way. Centre in the universal lathe by the upper hole; centre and drill for the lower hole, and finish the outside of it while it is up in the lathe; take it out and take the plates apart, and fit the lower pivot, and try the end-shake. To give it enough put the lower plate back in the universal lathe and face off the bridge, or bush rather, until you get it right; or if you choose you can cement the bridge upon your brass chuck in another lathe, which at times is a very convenient way of doing.

If the fuzee is jewelled top and bottom, fit a bush into the hole in the plate (supposing the party did not wish to pay for a jewel), and give it a shape similar to a jewel with steel setting, and polish it up nicely, and it will look very well; or make a brass bush just the shape of a jewel, and fit it into the steel setting, which also looks well. If the lower bridge has a jewel screwed in, proceed same as with the upper bush. If it was rubbed in, shape the bush so as to rub it in also. To do this knock out the old setting and turn up a bush just like the old setting, only making it solid; drill a hole through the centre, or better still, have it solid; next cement the bridge upon a brass chuck, and then put the bush into it, having chamfered off its outer edge; cut a slight groove around the hole in the bridge, and with a burnisher rub in the bush, screw the bridge in, put the plates together, and put up in the universal lathe and drill the hole in the lower bush, and then fit the pivot and get the end-shake as before described. All this is some trouble, but it is quickly done, and when well done it will be a satisfaction to you and of value to the watch.

We sometimes find the groove in the fuzee so worn from having carried a chain that was not the proper thickness, or that has been filed by some one, so that the chain will at times slip when winding. When it will admit of it, the old groove can be recut so as to make it answer a very good purpose where the owner of the watch will not pay for a new fuzee. Without taking the fuzee apart, put it up in the lathe with a spring chuck, or cement it upon a brass one if you choose. If you use cement you had better take the fuzee apart; fasten your rest a little below the centre and parallel to the spindle, then with the cutter in your right hand commence at the largest part of the fuzee and take a light cut, carefully turning the lathe with your left hand so as to make it go very slow, keeping the cutter against the fuzee until you wish to run out at the snail. By repeating this process several times you will get the fuzee into a tolerable condition, at least, so as to hold the chain as good as ever.

You can make a cutter out of an old thick graver. Draw the temper, then file the end up square; then file away the metal on the right-hand side of the graver (when the cutting end is pointing from you) for about a quarter of an inch back from the end, leaving a thin cutter on the left about the thickness of the chain; now temper and sharpen it, having cut away the lower side enough to give the edge a good cutting angle, which for brass can be very obtuse. This little tool, with a little practice, will enable you to improve many an old fuzee that you would otherwise have to replace by putting in a new one, and last as long as the balance of the watch. Some-one may have a better plan of renovating an old fuzee than this, but certainly not a more expeditious one, as it will not take three minutes to make the old groove quite passable in this way.

It frequently happens that the square of the fuzee has become so worn that either a new square or a new fuzee must be put in; and, of course, in this case, the best plan is to put in a new one. Select one of the proper size and thickness, being careful to see that it will give the chain the proper number of turns, and the groove all perfect, and of the proper width for the chain. Put a brass chuck, about an inch long, in the lathe, make a deep centre in the end of it, heat with the lamp until it is hot enough to melt shellac, then apply plenty of it to the end of the chuck, holding the lamp so that the flame will strike the chuck and the cement at the same time; warm the fuzee, and place the lower pivot in the cement and true it up by the upper pivot. If the watch is a plain one—that is, not jewelled,—broach out the old hole just sufficient to make the hole round, then polish it with a round broach. If the fuzee hole is jewelled, examine it to see if it is well polished; if it is not, it must be polished with diamond powder or tripoli, directions for which will be given when we come to speak of jewelling.

Now turn down the pivot so that it will almost enter the hole, leaving the shoulder the same height above the body of the snail as the old one. Turn out the hollow and mark on the pivot with the graver, by turning out a small groove for the bottom of the square, and make a good centre on the end of it. It is now ready for the grinding process. First grind out the hollow with oilstone powder, and oil on the end of a nail filed up the proper shape, using considerable pressure, and file up the end of the nail frequently, as it soon wears smooth. The oilstone only cuts the steel, while the grinder is rough. I say use a nail, from the fact that iron is better for this purpose than steel, and nails are always to be had. Continue grinding until every sign of the graver is removed, then with a steel polisher, such as already described, grind the pivot so that it will enter the hole easily, bearing in mind that it must be turned so near the size wanted as to require only just sufficient grinding to eliminate the marks of the graver. Carefully clean off every particle of oilstone powder, and for this purpose nothing is better than fresh, soft, light bread, which should be worked with the fingers so as to make it more compact than when just taken from the loaf; this is what is used by all jewel makers and finishers (those who fit and polish up all the steel work in hand-made chronometers and watches). If bread is not convenient, use alcohol and a brush, then pith.

Next use from two to three different grades of crocus or rouge on bell-metal polishers, shaped like the iron and steel ones, cleaning off every particle of the coarser kinds of each before applying the finer one. It will take some time and considerable pressure to bring up the "hollow" so as to produce that beautiful black polish usually seen in the steelwork of fine English watches. Lastly, use Vienna lime and alcohol on boxwood. The upper pivot proper, shoulder and hollow, being finished, take the fuzee down and again cement it up in the lathe, this time with the lower pivot out.

(To be continued.)

Bronzes and Ivories.—The Burlington Fine Arts Club are exhibiting in their rooms an important and singularly interesting collection of bronzes and ivories of European origin, ranging from the later days of original Greek art to the beginning of the eighteenth century. An excellent catalogue, with introductory notice, has been prepared.

HALL-MARKING.

In the general revival of the arts which the last twenty years have seen one branch has not shared. It remains dry and withered, puts forth no blossom, ripens no fruit. The number of our painters and sculptors has trebled. Architecture flourishes. Furniture and house-decoration are only too much thought of and studied. Our cups and saucers are works of high art. Even private houses show examples of stained glass which a cathedral could not have obtained in the last generation. More than all, the ordinary costume of the contemporary lady is graceful and picturesque, except in one particular, to be noticed presently; and, if nothing very original has been accomplished, the best examples of other ages have been successfully followed. But, while everything else has gone forward, goldsmiths' work, save in the hands of some exceptional artists, has stood still. The lady in mediæval costume will be heard lamenting that she can get no jewellery to match her gown. The noble oak sideboard is frequently furnished forth with racing cups, for more appropriate plate cannot be procured. Even our altars may be found set out with cups and patens but too plainly cast after some better model, not well imitated. The decadence of the arts of design in precious metals has been lamented by many recent writers; but it has not been found possible to stir the goldsmiths as a body to better things. Nothing can be more disheartening than a visit to some great store of silver plate. We are often invited to inspect the new Communion service ordered for a cathedral, or the suits of diamonds and rubies destined to adorn a royal bridal, or the vase of so many thousand ounces to be competed for at some great meeting. But we proceed to the show with mournful anticipations, as, we expect, with a too often safe instinct, to be shown only an immense treasure of gold, silver, and precious stones. We see mechanical skill of the highest order. And we are haunted for days by a vision of anachronisms, mixed styles of design, statuettes in false anatomy, meaningless ornament, purposeless twisting and torturing without aim or object, except to employ so much metal and obtain such a price. We have seen a cup made in the shape of the thirteenth century, and covered all over with a feeble and shallow chasing of vines and grapes of the eighteenth; or even worse, a vase of the classical pattern in vogue under George III., diapered with quaterfoils of the time of Edward III.; or a mock Cellini ewer covered with a relief representing cutters sailing; or a casket for an address, on which the lettering was Gothic, the emblems heathen, the form mediæval, the ornament classical, and the whole effect to the eye much the same as that which would be produced on the ear by the Dead March from *Saul* played in waltz time.

The reasons which are assigned for this melancholy condition of an important art are various, as might be supposed, but among them that to which attention has been chiefly directed of late is "Hall-marking." During the Parliamentary session of last year a select committee was appointed by the House of Commons to "inquire into the operation of the Acts relating to the Hall-marking of Gold and Silver manufactures." At the end of the session the committee reported the evidence, without having come to any conclusions upon it, except that they approved of a Bill providing for the more effectual protection of the watch-case manufacture. An immense body of evidence came before them on the general subject, and has been published in a Blue-book; but the full report of the committee has only been very lately issued. It is evident to any one who knows what hall-marking is that, let it be enforced with the utmost mildness, it is still a heavy tax on the manufacturer, and, what is more, on the designer of any work in precious metal pretending to high art. Every such work must be taken to Goldsmiths' Hall in the City—except in the case of the provinces, for which halls are provided at Edinburgh and Glasgow, at Dublin, and, for England, at Birmingham, Sheffield, and four other places. At the hall the testing is performed, and the article tested receives a series of marks, technically termed the hall-marks, which consist of a number denoting the proportionate fineness of the metal; of a letter, which signifies the current year; of a duty mark, the Queen's head; of two other stamps, a crown and a leopard, or lion passant, all which are necessary to proper and complete marking. The testing is performed by cutting or scraping off a minute portion of the article to be assayed. This fragment is accurately weighed and then melted in nitric acid, which liberates the alloy. The pure gold remaining is then again weighed, and the difference between the first weight and the second is the proportion of alloy. The process in the case of a silver article is somewhat different. The specimen is melted by heat, in a crucible which absorbs the baser metal and leaves the silver. This practice, which has been repeatedly sanctioned by Act of Parliament, began in England as early as the fourteenth century, by an ordinance of the King. Our coinage contains two carats of alloy in twenty-four, but jewellery is generally only eighteen carats fine.

It need hardly be observed that manufacturing jewellers, as a class, complain of the expense and trouble to which this system puts them; but it is only of late years that the decay of the goldsmiths' art, as art, has been laid to the blame of hall-marking. Mr. Watherston and others have not hesitated, however, to assert distinctly, that in their opinion, these restrictions have had the effect of driving away from our shores skilled labour in the precious metals. They have given evidence to this effect before the committee, and many pamphlets have besides been published setting forth their views. These pamphlets are of the usual type of such productions, wasting much room in declamation and quotations from Shakspeare, but containing, nevertheless, many valuable facts. One writer's opinion is that hall-marking should be voluntary, not compulsory. "The public, doubtless, will desire hall-marked plate as they now desire and obtain hall-marked chains. It will be in their power to obtain what they want. No one wishes to prevent them. But that a manufacturer or shop-keeper should be under serious pains and penalties for selling an article without a hall-mark, if he can find a customer, is no longer to be tolerated." He thinks that the duty on silver, which is collected by the "halls," has had an effect on trade out of all proportion to its value. In the year 1855 the duty was paid on 994,000 ozs.; in 1877, only on 798,000 ozs. The tax is 1s. 6d. an ounce; and the advocates of its abolition attribute to it, not only the depression of the trade, but also the deterioration of the manufacture. A drawback of 3d. is allowed on plate sent to be marked before it is finished and on plate exported new, but the expense of obtaining it amounts to a tax itself. "An agent is required to convey the goods to the port of exportation. The articles, whatever they may be, must be packed in an open case. Upon arrival at the port the plate must be taken out and weighed; ivory handles must be detached; knife handles must be drawn; every conceivable hindrance is offered to the trader." The expense of obtaining the drawback often exceeds the amount of the duty. Thus, the cost of collecting 19s. 7d., in one case, amounted to 23s., and so carelessly is the necessary repacking sometimes done, that lately a pair of candelabra forwarded to an Oriental potentate arrived in pieces, rendering a return trip to England needful, with a fresh duty on importation, and the same risk on re-exportation. We have all experienced the tender mercies of Custom-house packers, and can sympathise with the woes of the silversmiths. The whole silver trade of the United Kingdom does not amount to £400,000 a year. Mr. Watherston observes that it is not in the nature of things that a declining trade should attract artists; and he contrasts the case with that of America, "where one manufacturer, giving employment to eight hundred hands, works up, annually, more silver than all the British silversmiths put together." But he adds, significantly, this manufacturer's goods are remarkable for their artistic excellence. It would be difficult to convince an English maker that this last little fact has much to do with the American's success; but in spite of the tax, and the hall-marking, and the export troubles, we cannot help thinking that an attempt to employ first-rate designers would have a beneficial effect on the sale of English plate.

The inquiry pursued by Sir Henry Jackson's committee chiefly related to the importation of American and Swiss watch cases. There is great depression in the English trade in these articles, and the Clerkenwell makers are undersold by the foreigners. A Swiss watch has a case so thin that it could not be hall-marked without injury. The opinion of several witnesses may be summed up to mean that, if foreign watches come to this country without being sent to Goldsmiths' Hall to be stamped, English watches ought not to be stamped. The committee have not endorsed this view. Their report, it is true, recommends the abolition, whenever the condition of the revenue will admit of it, of the duty on silver plate. But it would keep up the principle of compulsory assay. The proposal of an optional or voluntary system of hall-marking is not considered satisfactory. The report does not touch the principle of the permissive marking of foreign watch-cases, but recommends that where foreign manufactures are assayed in this country, a distinctive sign that they are foreign should be employed, as they are now often thought to be of English make because of the hall-mark. No doubt, if the duty is abolished, one heavy restriction on silversmiths' work will be removed, but the report, in retaining hall-marks, and even adding to their number and extending their incidence, leaves the main objection unanswered. It cannot be denied, and is, in fact, denied by no one, that hall-marking does restrict the artistic working of gold and silver. The licensing of silver dealers is another restriction. Should one of our greatest artists model a statue or a bas relief, or design a cup, in gold or silver, it could not be sold as a work of art without a journey to Goldsmiths' Hall, "a trial by fire," a marking, and the possession of a licence by the seller. These are, after all, but small matters. Yet it is such small matters that cause an obstruction. The whole traffic of London Bridge, where two thousand vehicles pass one way in an hour, is stopped if a single horse falls. The abolition of the tax may help to stimulate trade in gold and silver plate, but, unless we are greatly mistaken, the tax is less felt by the manufacturer than the compulsory hall-marking. In the present days of electrotyping it is no real protection to the buyer, so easily is it imitated, and this fact does not appear to us to have been sufficiently considered by the committee. Indeed the principal reason expressed in the report for retaining the compulsory hall-mark is, that it "has existed substantially in its present form since the reign of Edward I."; and it is acknowledged that if it were in contemplation now for the first time to institute an Assay Office under the control of Government, the objections to the system might prevail. It is not out of tenderness to the Worshipful Company of Goldsmiths, however, that the retention of hall-marks is recommended; for, unless we are very much deceived in the language of the report, something very like the abolition of that time-honoured control is advocated. "The whole of the assay offices," says the report, "should be placed under the direct supervision of the Mint."—*Saturday Review.*

THE HISTORY OF GOLD WAR MEDALS.

At the last meeting of the Liverpool Numismatic Society, held at the Free Library, William Brown Street, the President, Mr. Reginald Harrison, F.R.C.S., in the chair, an interesting paper on the gold medals awarded to British troops was read by Major J. Lawson Whalley. The Major prefaced his paper by remarking that a few years ago little or no interest was taken in the subject, and such a thing as a collection of war medals was unheard of, their only value being that of old metal; but now this was changed, and much of the change was due to Mr. Gibson, the honorary secretary of the Liverpool Numismatic Society—Liverpool being the birthplace of the pursuit. The earliest medals were awarded in the reign of Charles I., and were only granted to officers in command and others of high rank, and with the single exception of the Battle of Dunbar, no medal was issued to officers and men alike until the battle of Waterloo. Charles I. awarded Sir Robert Welsh a medal for his distinguished services at the battle of Edgehill in recovering a royal standard which had fallen into the hands of the Parliamentary forces. The next medals were given by Cromwell, and bore the inscription "Lord of Hosts," and on the reverse a representation of the House of Commons. The officers received a small gold medal and the men received larger medals in silver. During the civil war medals were issued on both sides, but they seem to have been worn as badges, and were not awarded for military merit. The next important medal to which Major Whalley called attention was one commemorative of the battle of Culloden in 1746, but in all probability it was only awarded to a few superior officers, as its issue seemed to have been extremely limited. Major Whalley next noticed the medals issued during the Napoleonic wars, and drew particular attention to one conferred by the Emperor of Germany upon officers of the 15th Light Dragoons, which regiment prevented the French taking him prisoner in 1794. Another medal was conferred by Pope Pius VI. on the officers of the 12th Light Dragoons in admiration of their conduct in 1793. In 1799 medals were struck in gold and other metals for the storming of Seringapatam, the officers receiving medals of gold, and the Sepoys medals of tin. The other medals noticed by Major Whalley were medals granted by the Grand Seignor to the British troops for services in Egypt in 1800, and a medal given for the battle of Maida in 1806, and the medal and clasps given for services during the Peninsular War. No more gallant action, he said, was performed during the Peninsular War than that of Lieut. Latham, of the 3rd Buffs, at Albuera, who prevented a king's colour falling into the hands of the enemy. A French tooper cut Lieut. Latham's head severely, and afterwards cut off his left arm, with which he held the colour, when Lieut. Latham seized the colour with his right hand and placed it under his body, saying at the time, "I'll surrender it only with my life." A regiment of British cavalry came up at the moment, and the French had to retreat. The 3rd Buffs subscribed £100 for a medal for Lieut. Latham, who survived his wounds. After noticing other regimental medals, and the medals given by the Sultan of Turkey to British officers during the Russian War of 1856, Major Whalley said the presentation of gold medals to the British Army had long since ceased, and had been replaced by a better system—that of giving silver medals to officers and men alike. Major Whalley exhibited specimens of most of the medals mentioned in his paper, which was listened to with great interest, and was frequently applauded. On the motion of the chairman, a vote of thanks was passed to Mr. Whalley, who, in replying, promised to read a paper on gold war medals awarded to the British Navy.—*Pawnbrokers' Gazette.*

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Mr. J. H. JOHNS is the only authorised traveller for this Journal.

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PATENTS.

Patents granted in British Colonies and Dependencies.

9764. DANIEL A. A. BUCK, of Worcester, Mass., U.S., for "Improvements on watches." (Perfectionnements aux montres.)—5 years.—Dated 19th March, 1879.

9851. F. FITT, of Ottawa, Ont., for "A watch-going barrel."—Dated 17th April, 1879.

Patents Sealed.

1172. ALFRED HAVILAH WOODWARD, of Birmingham, in the county of Warwick, Penholder and Pen and Pencil Case Manufacturer, for an invention of "Improvements in double-acting spiral pencil cases, pen cases and tooth-pick cases."—Dated 24th March, 1879.

5261. ALBERT HILL, of Reading, in the county of Berks, Watchmaker, for an invention of "Improvements in apparatus for indicating the time."—Dated 24th December, 1878.

Notices to Proceed.

554. WILLIAM WRIGHT, of Birmingham, in the county of Warwick, Jeweller, has given notice in respect of the invention of "Improvements in scarf-rings, which improvements are applicable to brooches, dress-holders, and such like articles."

1191. THOMAS SOUTHGATE, of Burton Crescent, in the county of Middlesex, Gun Maker, has given notice in respect of the invention of "Improvements in the construction of wrist and other studs or solitaires."

529. And THOMAS HENRY BLAKE, of Sheffield, in the county of York, Secretary to Edwin Round & Son (Limited), Electro Platers and Manufacturers, 36, Holly Street, Sheffield, has given notice in respect of the invention of "An improved process of electroplating by an amalgamation or combination of silver and alloys of tin and other metals."

527. ALEXANDER MELVILLE CLAKK, of Chancery Lane, in the county of Middlesex, Patent Agent, has given notice in respect of the invention of "Improved striking or chiming mechanism for clocks."—A communication to him from abroad by William Lindon of Brookly, in the county of Kings, state of New York, United States of America.

1117. WILLIAM ROBERT LAKE, of the firm of Haseltine, Lake, & Co., Patent Agents, Southampton Buildings, London, has given notice in respect of the invention of "Improvements in the manufacture of gold-plated metal, and in articles made thereof."—A communication to him from abroad by Lucien Joseph Falize, junior, of Paris, France, Goldsmith and Jeweller.

Grants of Provisional Protection for Six Months.

1962. To HENRY GRIFFITH, junior, of Birmingham, in the county of Warwick, for the invention of "Improvements in the construction of studs and solitaires."

1984. To GEORGE WILSON HEATH, of Crayford, in the county of Kent, Nautical Instrument Maker, for the invention of "Improvements in sextants and octants, parts of said improvements being applicable to telescopes."

1955. To HENRI ROBERT, of 34, Clerkenwell Road, in the county of Middlesex, Watchmaker, for the invention of "Improvements in watches."

2089. To LAURENTIUS ANDREAS WALDEMAR LUND, of Birmingham, in the county of Warwick, for the invention of "Improvements in studs and solitaires."

2066. To WILLIAM ROBERT LAKE, of the firm of Haseltine, Lake & Co., Patent Agents, Southampton Buildings, London, for the invention of "An improved alloy designed as a substitute for silver in the manufacture of metal goods."—A communication to him from abroad by Jean Baptiste Théodore Despiau, of Ayguemorte, France.

Patents on which the Stamp Duty of £50 has been paid.

2578. CHARLES LOUIS AULAGNIER, of Bedford Street, Strand, in the county of Middlesex, for an invention of "Improvements in watches."—A communication to him from abroad by Vve. de J. Soldano, fils, of Geneva, Switzerland.—Dated 22nd June, 1876,

Applications for Letters Patent.

2438. WILLIAM FREDERICK WILLIAMS, of 3, 4, and 5, Little Windmill Street, in the county of Middlesex, and ALBERT BARKER, of 144, New Bond Street, in the said county of Middlesex, silversmiths, for an invention of "An improved mechanical wine, spirit or liqueur stand."—Dated 19th June, 1879.

2490. JACOB MERZBACH, of Holborn Viaduct, in the city of London, for an invention of "An improved clock movement."—A communication to him from abroad by Oreste Blanchetti, of Paris, France.—Dated 21st June, 1879.

Patents Granted in Foreign States.

BELGIUM.

47,999. J. E. ORRY, for "A chain necklace."—Dated 22nd April, 1879.—Original Patent, 23rd March, 1878.

48,216. WOLF-HIRSCH, for "Fasteners for earrings."—Dated 15th May, 1879.—Original Patent, 10th November, 1876.

AUSTRIA.

46. J. FEIX, of Albrechtsdorf, for "Fixing glass and enamel on jewellery."—Dated 3rd January, 1879.—Class 6.

ITALY.

58. P. GORINI, of Pavia, for "A differential clock."—Dated 19th October, 1878.

118. E. GANELLI & F. BARDELLI, of Turin, for "Applying apparatus for electric transmission to watches and chronometers."—Dated 20th November, 1878.

125. A. LION, of Paris, for "Articles of jewellery and their manufacture."—Dated 21st November, 1878.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

DAVIS, DAVID JOSEPH, Elizabeth Street, Cheetham, Manchester, jeweller. May 29. W. Rylance, sol., Essex Street, Manchester.

MARSTON, WALTER STARKEY, Spon Street, Coventry, watch manufacturer. May 27. A. Seymour, sol., Coventry.

PAGE, JOHN AUSTIN, Caistor, Lincolnshire, watchmkr. & jeweller. May 20. H. C. Chambers, sol., Market Rasen.

DAVIS, MATHEW, Hill Cross, Coventry, watchmanftr. June 4. J. H. Kilby, sol., Coventry.

BARNETT, ELI LOUIS, Great Hampton Street, Birmingham, jeweller. June 7. Hodson & Haigh, sols., Waterloo Street.

EDWARDS, THOS. RICHARD, Augusta Street, Birmingham, & Clifford Street, Aston, electro plater (sep. crdtrs.). June 7. C. H. Edwards, sol., Waterloo Street, Birmingham.

ROPER, HENRY & THOS. RICHARD EDWARDS, Augusta Street, Birmingham, electro platers. June 7. C. H. Edwards, sol., Waterloo Street, Birmingham.

Baddeley, John Dodwell, Geach Street, Birmingham, jeweller. June 10. E. Jaques, sol., 40, Cherry Street, Birmingham.

Glue, David, Stockport Road, Manchester, jeweller. June 13. D. W. Tremewen, sol., 41, Ward's Buildings, Manchester.

Goodrich, Frederick, Cricklade, jeweller, &c. June 9. J. S. Lovett, sol., Cricklade.

Lock, John, Tottenham Court Road, & University Street, watchmaker. June 7. E. A. Hunt & Co., 23, Charlotte street, Bedford Square.

Morgan, Henry William, Lake Road, Landport, jeweller. June 11. Blake & Reed, sols., Portsea.

Guye, Philippe, Geneva, Switzerland, Auguste Guye & Fritz Guye, Macaulay Road, Clapham Common, London, tradg. as P. & A. Guye, at 13, Northampton Square, Clerkenwell, & St. Bride Street, Ludgate Hill, watch manufctrs. June 11. Abrahams & Roffey, sols., 8, Old Jewry, July 9, at 3.

Guye, Auguste, Northampton Square, Clerkenwell, St. Bride Street, Ludgate Hill, & Macaulay Road, Clapham Common, watch manufctr. (sep. cdtrs.). June 11. Abrahams & Roffey, sols., Old Jewry. July 9, at 4.

Treadwell, Amos, Fountain Court, Strand, late Church Street, Edgware Road, clock maker. June 5. G. L. Norman, sol., 29, Essex Street.

Bevan, Edward, Argyle Street, & James Street, both Birkenhead, watch manufacturer and jeweller. June 20. At J. G. B. Mawson, acct., Birkenhead, July 7, at 12½. T. M. Bleakley, sol., Birkenhead.

Cornish, Herbert, Swansea, jeweller. June 18. Hartland, Davies, & Isaac, sols., Swansea.

Crichton, Alex. & Chas. John Curry, 45, Rathbone Place, silversmiths. June 19. At Nelson, Son, & Hastings, sols., 18, Bennett's Hill, Doctor's Common, July 7, at 3.

Crichton, Alexander, 87, Cambridge Road, Nth., Hammersmith, and 45, Rathbone Place, silversmith (sep. crdts.). June 19. At Nelson, Son & Hastings', sols., 18, Bennett's Hill, Doctor's Commons, July 7, at 4½.

Maitland, John Martin, Market Street, Ulverston, jeweller. June 20. At Temperance Hall, Ulverston, July 7, at 11. F. O'N. Pearson, sol., Ulverston & Grange.

Martin, George, Wind Street, Swansea, jeweller. Juno 18. At Queen's Hotel, New Street, Birmingham. Hartland, Davies & Isaac, sols., Swansea.

Trustees Appointed.

Burrow, Robt., trdg. as R. Burrows & Co., (Liq.), Hatton Garden, & Arlington Square, Islington, watch importer. Tr., G. Holloway, 128, Minories, watch importer.

Schwarar, John G. (Liq.), Sheffield, jeweller. Tr., C. Corbidge, jun., Sheffield, accountant.

Adams, Geo. (Liq.), Coventry, watch mfctr. Tr., H. Suffolk, Coventry, accountant.

Barwick, Brice W., Thomas Barwick and John K. Barwick, trdg. as Barwick Bros. (Liq.), Keighley, jewellers. Tr., W. Weatherhead, Keighley, auctioneer, & C. Corbidge, jun., Sheffield, accountant.

Barwick, Thos. (Liq.), Keighley, Yorks, jeweller (sep. estate). Tr., W. Weatherhead, Keighley, auctioneer, & C. Corbidge, jun., Sheffield, accountant.

Payne, Wm. (Liq.), High Holborn, trdng. as Payne & Son, Lowndes Street, jeweller. Tr., G. Greiner, 53, Aldermanbury, mcht., & W. F. Williams, Little Windmill Street, Golden Square, silversmith.

Steer, Henry (Liq.), Derby, jeweller. Tr., E. Belfield, Derby, account.

Dividends.

Boyall, Joseph (Liq.), Spilsby, jeweller. 2nd and final div. 3/-; F. B. Leeming, 10, Colcman Street, London.

Garnier, Edme. M. T., late trdg. as Shuff & Garnier, 34, Great Marlborough Street, jeweller. 1st div. 5/-; S. Slater, 32, Queen Victoria Street.

Lemmon, Chas. (Liq.), Croydon, watchmaker. 1st & final div. 2/-; any Wednesday between 11 and 2. G. Emdin, 72, Colcman Street.

Adjudications of Bankruptcy.

Bamber, Jno. Wignall, 120a, Church Street, Preston, jeweller. June 17. At C. C., Preston, July 14 at 12. Hulton, Reg.

Dissolutions of Partnerships.

Whitaker & Land, Wakefield and Mexbrough, watchmakers. March 4.

Ricketts, Laurie & Co., Arthur Street, Oxford Street, electro-plate manufacturers. May 26.

Grossman & Little, Ely Place, Holborn, watch manufctrs. May 7.

Hales & Room, Vyse Street, Birmingham, manufacturing jewellers. May 16.

Boss, Albert, & Co., Charterhouse Street and Paris, diamond merchants. February 1.

Norman, H. & A., 6, Pavement, Wimbledon, jewellers. June 11. Debts by Albert Norman.

Sanders, Chas., Jun., & Co., Warstone Buildings, Hockley, Warwickshire, jewellers. May 17. Debts by Charles Sanders, jun.

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Allgemeines Journal der Uhrmacherkunst.

Illustrirte Fachzeitschrift für Uhrmacher.
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The "Allgemeine Journal der Uhrmacherkunst" has taken upon itself the task of improving the art of watchmaking, and to protect and further the interests of the trade.

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This popular German periodical appears fortnightly, and may be had, post paid, for 2s. per quarter, and 7s. per annum. Single Copies, 6d. Advertisements are charged at 3d. per four-parted line. The journal is noted for really practical and scientific articles, and abounds with information concerning the requirements in the Art and Trade of Watchmaking. The great circulation of the same amongst Watchmakers in all parts of Germany and German Watchmakers abroad, secures for advertisements the best possible effect. Orders for Subscriptions and Advertisements at Original Prices, carried out for Great Britain and Colonies—H. Bush's Publishers' Agency, Hull, Yorkshire; and for the United States—H. Horend, 185, East Broadway, New York.

ART CASTINGS IN STEEL.

At the recent meeting of the Iron and Steel Institute various art castings in steel were exhibited by Hadfield's Steel Castings Company, of Hecla Foundry, Sheffield, whose various art reproductions in steel excited great interest amongst metallurgists, it having previously been deemed impracticable to cast such articles in steel. These art reproductions illustrate some of the latest triumphs in the art of steel casting. One of these antique pictures in steel is a *repoussé* shield by Benvenuto Cellini, the famous artist in metals of the sixteenth century, and it is supposed to represent the siege of Troy. Four other pictures represent the elements—earth, air, fire, and water. The bas relievos are copies from the house of Henry the Fourth of Paris. Another represents the seasons—spring, summer, autumn, winter. Another subject is children at play, and another an eastern subject. These pictures are after the style of the French bronzes shown at the late Paris Exhibition, and were greatly admired by experienced and practical steel makers, who know how difficult it is to obtain sound castings in steel; but this firm are noted for their specialities in steel castings.

IMPORTATIONS OF CLOCKS AND WATCHES.

During the month ended April 30th 81,411 clocks were imported into this country, valued at £48,241. The imports for the same period last year were 72,535, value £48,615. The imports for the four months ending April 30th were 244,018 clocks, value £158,346, and during the corresponding period of 1878, 213,262, value £163,180.

Watches to the amount of £46,321 were imported during the month of April of the present year, and £45,088 worth during the same month last year. The period of four months ending April 30th gives a total of £158,310, and £154,616 for the years 1878 and 1879 respectively as the value of imports of watches.

MORE ANTIQUE JEWELLERY.

Dr. SCHLIEMANN has again had the good fortune to unearth from the depths underneath the site of the Homerick Illum, at Hissarlick, more "treasure-trove." No less than four buried hoards of pre-historic treasures have been discovered—one consisting of gold earrings, bracelets and beads, and one—by far the most precious of all—consisting of a bronze vessel filled with gold earrings, bracelets, and beads, with a spiral pattern on them, a large round piece, and sixteen bars of solid gold, several silver ornaments, and some bronze axes. All these relics of antiquity will enrich the Imperial museum, as, by his compact with the government, although Dr. Schliemann is to bear the entire cost of the excavation at Hissarlik, all antiquities found are the property of the museum. According, however, to another authority, the treasure-trove will be equally divided between Dr. Schliemann and the Turkish Government.

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WATCH DIAL ENAMELLER,
SOLE AGENT FOR BRUTON'S ENAMELS.
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A. H. WOODWARD'S
PATENT DOUBLE-ACTION SPIRAL PENCIL CASE,
WITH RESERVE OF LEADS.

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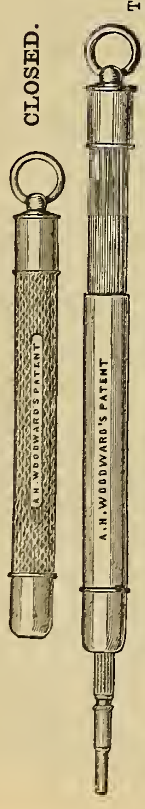

Trade Price per doz.
NICKEL-SILVER, PLAIN, ENGINE-TURNED OR ENGRAVED, 2/- EACH. 16/-
BEST ALUMINIUM GOLD, PLAIN OR ENGINE-TURNED, 3/- EACH. 24/-

By an improved method (Patented March 24th, 1879) in the internal Mechanism of this Case—which is the acme of ingenuity and simplicity, and free from all possible derangement—the Patentee is enabled to offer it at half the usual price charged by other Makers for ordinary inferior articles.

THE HANDIEST PENCIL CASE EVER INVENTED.
Its great utility will speak its own recommendation.

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DOUBLE-ACTION SPIRAL PEN AND PENCIL CASE.

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The Greatest Perfection in Pen and Pencil Case Mechanism ever yet Attained.

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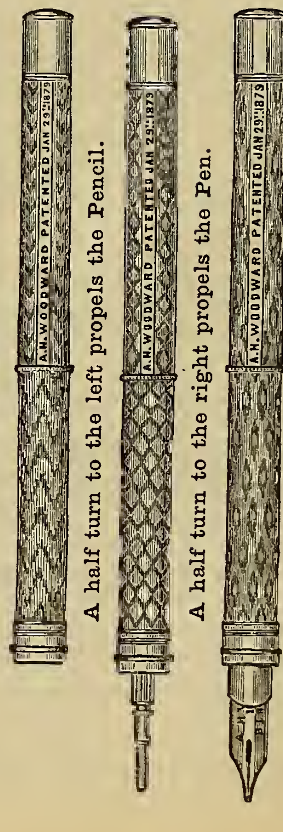
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A half turn to the left propels the Pencil.

A half turn to the right propels the Pen.

HUNDREDS OF TESTIMONIALS pronounce it to be the HANDIEST CASE OUT, and a real treat to use.

THE PAPER AND PRINTING TRADES JOURNAL OF APRIL, 1879, says:—"Without any exception whatever, the Handsomest, Handiest, and most perfect Writing Tool ever Invented. Made of Aluminium Gold, it is somewhat heavier and more massive in appearance than ordinary Pocket Pen and Pencil Cases, but its extra solidity and weight give it that strong and high-class feel and appearance so dear to the judge of a good article."

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THE
WATCHMAKER
JEWELLER.
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SILVERSMITH'S
TRADE
JOURNAL.
W.H. TILBY

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CONTENTS.

Horology 15
International Exhibition of Machinery and Tools at Geneva 16
Meeting of Manufacturing Jewellers at Birmingham 17
Prices Current for Gold and Silver .. 17
Glasgow Goldsmiths' Company 18
Polishing Aluminum.. 19
New American Patents 19
Correspondence 19
Rubies 19
New German Tariff 19
Hints to Repairers 20
Discovery of Roman Coins 20
Trade Recipes, &c. 21
Birmingham Jewellery Trade 21
Importations of Clocks and Watches .. 21
Competition for Going Barrel and Stopwork 21
On the Compensation of Clocks, Watches and Chronometers 22
The Silver Duty and Hall-marking Question 24
Aluminum Solder 24
Patents 25
Monthly Record of Bankruptcies 26
Directory ii
Advertisements .. .. i-x

No. 51.—Vol. V.] AUGUST 5, 1879. [Subscription, 5s. per Annum. Post Free.

HOROLOGY.

(*Concluded from page* 156.)

XLIII.—Adjustments to Positions, Isochronism, and Compensation.

Care must be taken that the run of the coils should appear to be even and continuous. So wound up and fixed by screws at either end, it is hardened in a thick iron box with a loose cover; the free space within the box, which ought to be about three times the diameter of the cylinder and somewhat deeper, is then filled with powdered charcoal mixed with some powdered ivory, and the whole is heated to a yellow heat, in which it must be kept about a minute, in order that the heat should get well diffused and imparted to the cylinder through the charcoal, which is a bad conductor of heat. Then it should be taken out of the fire and be reversed over a vessel containing oil, the loose-top and the cylinder falling into it, and the spring thus becomes hardened. Proceeding thus, the spring will be evenly hard throughout and never change its form, which sometimes happens when water is used instead of oil. Some makers wrap platina foil round the spring to exclude the air, and then the heating can be performed in a piece of charcoal by means of a blowpipe.

For hardening, cold water must be used in this case. Makers using this mode assert that in consequence of the spring being in contact with metal on each side while being heated and cooled, the granular disturbance within the spring will be less, and a spring so made will soon cease to accelerate its rate, an imperfection to which all springs except very soft ones are more or less subjected. There is a degree of plausibility attached to this argument in favour of this mode. Every maker has his own ideas, but the very fact that amongst a number of springs made by any maker the performance of a few only exceed the average degree of excellence, proves that assertions of this kind must be received with more or less caution. It is my opinion that the proportion between the degree of hardness and the length of the spring is the principal consideration. Some makers have the habit of hardening and tempering the spring and then trying whether it will suit the balance, and if the number of turns is between eight and twelve, they use it. Nothing can be more injudicious than that. He should first make up his mind about the number of turns he wants to employ (I should in no case recommend less than ten), and then temper the spring accordingly. If it does not suit the balance a different wire must be employed, or another spring made with another temper, less coils of course requiring greater hardness.

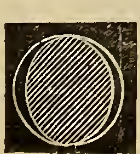
The great difficulty is that the change of colour is scarcely a sufficient guide for the degree of hardness in long springs, for in these low degrees a spring may be made considerably softer without being accompanied with a corresponding change in the colour. A better plan is based upon the fact that a hard piece of steel will colour with a smaller amount of heat than a soft one. If two pieces of steel, a hard and a soft one, be put together in a bluing pan, the hard piece will be of a rich blue before the soft one becomes purple, and when a hardened piece which has already been blued twice, after having been whitened after each bluing, is brought to a rich blue colour the third time, it will require a degree of heat which would have made it (had it not been whitened twice) of a very pale blue colour. As the time when the rich blue colour appears can be easily observed, the number of times the operation is repeated will be indicative of the degree of hardness. If a spring having ten coils is blued six times, including the final bluing, it will have a suitable degree of hardness.

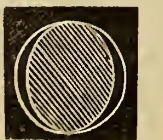
It is not necessary that the spring itself should be whitened each time, as the whitening of the screws fastening the wire to the cylinder will serve the same purpose. The spring before being finally blued and set to shape on a cylinder furnished with suitable grooves must be whitened with oilstone dust and wood, which is done partly in the turns and partly on a flat piece of wood fixed in a vice, and which is thin enough to go between the coils, to allow the sides or edges to be finished off. The necessary manipulations are so simple as scarcely to need more minute describing. In regard to fixing also, anyone having looked at another with any attention can hardly make a mistake. The curves must be bent with a pair of tweezers made expressly for that purpose, and to be had at any tool shop.

Flat springs are wound-up three at a time between a pair of platina plates, having three steady pins, and being screwed or pinned down to friction tightness, and so hardened. The best flat springs are, before final blueing, set to shape in a disc having suitable grooves on its plane.

In concluding his essay, Immisch makes a few valuable remarks on the subject of timing watches in positions. He says:—"Above all it is necessary that the frictional conditions in the pivots should be equalized as much as possible, inasmuch as, if too great a difference has to be counterbalanced by isochronal adjustments, any change in the extent of the arcs arising out of other than frictional differences (as change in the motive force while the watch remains in the same position, and imparted motion) will cause the long vibrations to be slower. In order to equalize these frictions it must be increased when in the horizontal, and diminished when in the vertical position, as much as possible. In the former case the flattening of the pivots or shaping the ends so as to form a slightly inclined plane (which latter manipulation causes the rubbing surfaces to act farther from the centre) will be necessary. In the latter case, thinness of the holes or a convex shape of the sides of the holes, and utmost finish of the pivots, will be required. The pivots should be conical in shape in order to be made thin without lessening their durability.

"As far as regards the vertical position, the greatest narrowness of the holes consistent with freedom of motion will be of importance. Very frequently differences arise in consequence of the incorrect form of the pivots. If they are not perfectly round, and are, for instance, of an oval shape, the going of the watch will be influenced in the same manner as if the balance was out of poise. Annexed two figures will make that more clear.





"There is, of course, always a very small shake in the holes necessary on account of the oil, and, when, therefore, such an oval-shaped pivot is in the position indicated in the first figure, its centre is farther from the lowest point of the hole than when it is in a position as in the second cut, and when the balance vibrates it gives way to the influence of gravity—it *falls* in each half of the vibration; the effect on the rate will be the same as if the balance was bottom heavy. If the long diameter of such a pivot is in a position as in the second figure, when the watch is in a quiescent state its effect will be the same as if the balance was top heavy. The existence of such an imperfection can be ascertained by changing the position of the roller or rollers on the balance staff. If the relative points of greatest differences change with the roller, they arise from the escapement; if they retain their position with respect to a given point of the balance, they arise from pivot imperfections, and it is best to change the staff at once. The balance should in all cases be perfectly poised. Any change in this respect is bad.

"No other than general rules can be given, as practice and experience are necessary to enable the artist to account for and to correct differences of a more complex nature, because the smaller the error becomes the more difficult it will be to reduce it, and is much more trying to the reflective powers of the artist than errors of a coarser kind. There is still a wide field to be cultivated by all watch makers who love their art, and although there are no more Government grants to be won by raising the standard of excellence of timekeepers, the object possesses so much intrinsic interest in itself as always to challenge an honourable ambition of the best in the art, their exertions being stimulated in addition by the requirements of the present age of railways and telegraphs, where a question of correct time becomes of greater importance every day."

INTERNATIONAL EXHIBITION OF MACHINERY AND TOOLS AT GENEVA.

We have previously informed our readers that an exhibition of machinery and tools employed by watch manufacturers, jewellers, musical-box makers, and kindred trades, was under consideration at Geneva, and it has now been definitively arranged that the event is to take place in May and June, 1880. The Exhibition is under the immediate patronage of the Genevese Society of Arts (Industrial Section), and is to be held in the handsome new building of the Horological School of that city. The direction is in the hands of an able and influential committee, and a receiving officer and staff will take up their quarters at the Exhibition building on the 15th of March next, when the reception of exhibits will begin. The Exhibition comprises six sections, subdivided into twelve classes.

Section I.

Class 1.—*Raw Materials.*—Rough and prepared metals, enamel, wood for marquetry work, materials for cases, chemical products for gilding, silvering, nickel-plating, electroplating, melting, colouring, polishing, etc.; oils, lubricators, etc.

Section II.

Class 2.—*Workshop Furniture and Fittings.*—Models and plans of workshops, systems of lighting, heating, and ventilation; benches, stools, safes, drawers, etc.

Section III.

Instruments, tools, and processes for measuring dimensions, weights, proportions of matter for ascertaining accuracy of work, and for reproduction.

Class 3.—Rules and graduated compasses, micrometers, balances, calculating tables, etc.

Class 4.—Compasses for proportions and depths, magnifying glasses, microscopes, etc.

Class 5.—Photographic and galvanoplastic proofs; impressions on plaster, wax, gutta-percha, etc.

Section IV.

Class 6.—*Motors and Transmitters.*—Small hydraulic, steam, gas, pneumatic, and hot air moters; pulleys, belts, ropes, lubricators, treadles, etc.; plans and devices.

Section V.

Machines, tools, and processes for working metals, wood, ivory, shells, etc. Chemical and physical agents.

Class 7.—Furnaces for melting, annealing, enamelling, tempering, etc.; forges, bellows, blowpipes, soldering-lamps, crucibles, muffles, ingot moulds; apparatus used for gilding, silvering, nickel-plating, electro-plating, colouring, etc.

Class 8.—*Mechanical agents.*—Machines and tools working by pressure or tension. Forging tools, anvils, hammers. Stamping machines, balances, rolling machines, wire-drawing machines, etc.

Class 9.—Machines and tools for dividing materials. Shears, balance-cutters, planes, cutting-machines, engine turners, lathes, fraises, drilling machines, etc. Systems of vices, stampers, etc.

Class 10.—Lapidaries' tools, polishing and scratch-brushing lathes, grinding-wheels, etc.

Class 11.—Vices, pincers, tweezers, etc.

Section VI.

Material for theoretical and practical instruction in the trades represented.

Class 12.—Special treatises, models and designs. Mathematical instruments, apparatus employed in tho teaching of geometry, mechanics, etc.

The opening of the Exhibition is fixed for the 1st of May, and the closing for the 30th of June; but if the Committee finds it advisable this term will be prolonged for another month. Exhibitors are subject to the following conditions:—

Only one specimen of each object can be shown by the same exhibitor, unless the Committee authorises otherwise to meet certain cases.

The exhibits are not to be withdrawn until the closing of the Exhibition.

Spaces are supplied gratuitously, as also tables destined to receive articles of small volume. The Committee pays also the cost of fire insurance.

Motive power for machinery of small calibre is supplied free of charge. Cost of installation and transit to and from the Exhibition building to be defrayed by the exhibitors. As the motive power at command is limited, the committee reserves itself the right to appoint the time during which the exhibitor can set his machines to work. If desired, the receiver will undertake the unpacking, arranging and re-dispatching of exhibits—of course, at the exhibitors' expense. Free entrance to the Exhibition is granted to exhibitors.

Applications for space must be made in writing to the *Comité de l'Exposition d'outillage, à l'Athenée à Genève.* The applicant will then receive a form on which must be entered the nature of the exhibits, space required, if they are to be placed against the wall, the floor, or on the tables; if they require motive power, and how much and what speed, etc. The committee has the right to accept or refuse applications for admission.

A jury of experts will examine the exhibits. Due regard will be paid to the different nations represented in the selection of the jury. Exhibitors can attend the visit of the jury personally or by proxy. Awards in the form of Diplomas will be made to successful exhibitors.

MEETING OF MANUFACTURING JEWELLERS AT BIRMINGHAM.

On Wednesday, the 16th ultimo, the manufacturing jewellers of Birmingham held a meeting at the "Goldsmiths' and Jewellers' Arms," Hockley Street, for the purpose of considering what steps should be taken by them in consequence of the Government contemplating the introduction of a clause in an Act of Parliament, restricting the hall-marking of articles of jewellery to 18 carat. There was a good attendance, and amongst those present were Messrs. W. Aston, H. Payton, T. Bragg, Taylor, Wilcox, G. E. Reading, Carter, Lawrence, C. B. Bragg, Green, Neale, Mantle, Mayers, Wainwright, Pendleton, Robotham, F. Payton, Hyde and Griffiths.

Mr. W. Aston, who presided, cited several clauses from the committee's report, and pointed out that the one which they had to consider was the recommendation to abolish the hall-marking of the lower standards of gold—namely, 9, 12, and 15 carats.

Mr. Payton suggested that they should organise themselves with a view to considering the Bill when it was brought before the House, and prepare themselves for giving evidence before any committee which might be appointed to investigate tho question of hall-marking in general. He thought the object of marking inferior qualities of gold was that persons who could not afford to buy 18 or 22 carat gold might know what they were buying.

Mr. C. B. Bragg said there was no necessity for their discussing the report on that occasion. It would be quite competent for them at a future date to obtain a copy of the draft bill, and then ascertain and act accordingly with reference to the proposals which would affect them. He proposed the following resolution, "That a committee be appointed to watch the interests of the Birmingham jewellery trade in all matters relating to the hall-marking of jewellery and silver goods, and that this meeting stand adjourned to the call of its present chairman."

The Chairman explained that he was really at the bottom of the meeting being called. As a guardian of the Assay Office he became aware of certain information, and he communicated with the members of tho trade with the view to their requesting him to summon that meeting. Since 1854 up to the present time the marking of 9 carat jewellery had so much increased—and he thought fairly increased—that in his opinion it was a standard which ought to be marked for the benefit of the people who could not afford to buy the 18 carat gold. (Hear, hear.) He was convinced that to abolish the standards of 9, 12, and 15, carat would be a serious thing for Birmingham. (Hear, hear.) He was certainly an advocate for the retention of all these standards, and as far as it lay in his power he should support their retention (Hear, hear.) The 9 carat standard had been in operation nearly twenty-five years, and during that time there had been a very great increase in the quantities marked, both of 9 and 18 carat were nearly on a par during the last seven years.

The resolution of Mr. C. B. Bragg, being duly passed, the following gentleman were chosen to form a committee:—

The Chairman, Councillor Payton, Messrs. J. Hyde, G. E. Reading, H. Griffiths, Mayell, J. W. Tonks, J. V. Barber, and R. Muntell.

A vote of thanks to the chairman concluded the meeting.

Prices Current for Gold and Silver.—Value given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver 4s. 6½d. to 4s. 9d. (variable according to quantity).

GLASGOW GOLDSMITHS' COMPANY.

THE following is a report concerning "Hall Marking" and laws affecting the trade, prepared by a Sub-Committee and unanimously adopted by the annual meeting of the above company, held at Glasgow, on 7th July, 1879—Wm. Alexander, Esq., presiding:—

Your Committee have to report that a complete consideration of proposed legislative changes affecting the Trading in Articles made of Gold and Silver involves—

(1) Consideration of the recommendation of the Select Committee of the House of Commons on Hall Marking (Gold and Silver), 19th May, 1879.

(2) The "Watch-Cases (Hall Marking) Bill." A Bill introduced this session by Sir Henry Jackson, M.P. for Coventry, "to amend the law relating to the Hall Marking of Watch-Cases."

Although the Watch-Cases (Hall Marking) Bill is to be found among measures proposed to be passed into law this session, yet, as the recommendations of the Select Committee specify a number of much more important particulars in which the Acts affecting the gold and silver trade require to be amended, and as the Watch-Cases (Hall Marking) Bill is not framed in harmony with, but rather in opposition to, the recommendations of said Committee's report, and is not likely to be passed into law before some action is taken regarding the more important changes recommended by the Select Committee, your Committee have confined their attention mainly to the report of that Committee. [For particulars of Select Committee's report, see last month's journal.]

Gold and Silver Duties.—With regard to the first of the foregoing recommendations, viz.:—The Abolition of the Silver Duty, Customs and Inland—your Committee would submit that such a change should be of great advantage to both the trade and the community, and its proposal is to be gladly welcomed. We would, however, point out that as the duties on gold equally with those on silver were imposed for the same reason, viz.: to increase the national revenue, and as the relation of injurious influence between the existence of duty and the progress of the trade, or working in both metals, is largely one of degree, your Committee think that the abolition of duty upon gold should take place simultaneously with the duty upon silver.

Hall Marking.—In the event of the duties upon gold and silver being abolished, your Committee are of opinion, that the system of compulsory Hall Marking should be replaced by arrangements for voluntary or optional Hall Marking. Where duty is levied upon silver and gold, the first use of the Hall Mark is really that of registering that the duty upon the article so marked has been paid. A second use of the mark is to inform all through whose hands articles so marked may pass, that these are made of metal of an ascertained and certified quality, and therefore of a known value. The second use is the only reason assigned for the maintenance of compulsory Hall Marking, viz.: that of affording the public a guarantee or protection almost unknown by other trades, and not available in the case of most articles of jewellery, and especially those of the highest value. As it seems most reasonable to expect, that if a great and general value is put upon Hall Marking by purchasers of gold and silver goods, the law of supply and demand will most effectively secure the continuance of satisfactory Hall Marking. Your Committee would therefore recommend that any change in the law regarding Hall Marking should be of such a nature as to encourage, by means of easy and efficient arrangements, a system of voluntary Hall Marking. Before passing from this subject, your Committee would point out that the gentleman who was examined by the Select Committee on behalf of the London pawnbrokers, gave evidence to the effect that during 1878, he sold 7,000 ounces of Hall Marked silver, and that the annual sales of the London pawnbrokers alone would probably amount to 300,000 ounces of English made and Hall Marked silver. This large sale of such silver goods was further shown to be mainly, if not wholly, due to the presence of the "Hall Mark." Year after year, therefore in a repeating, though ever enlarging circle, this large trade in Hall Marked silver goes on. But for the "Hall Mark" it is reasonable to believe that instead of buying old silver from the pawnbroker, many might purchase new plate from the silversmith, and to the extent of such purchases the silversmith trade would be extended, and to a much greater extent, promoted and encouraged. According to the same witness a proportionally large sale of Hall Marked gold jewellery is also effected by pawnbrokers. Your Committee would further remark that the recognition and adoption of the principle of compulsory "Hall Marking" for what is termed "the protection of the public," would involve and require an indefinite extension of the system of marking, and an almost endless variety of stamps and marks, while a voluntary system would most simply and fully meet the real wants of the public and the requirements of the trade.

Licenses.—If the duties on gold and silver are abolished, and, as seems the natural consequence, Hall Marking become voluntary, we fail to see why a jeweller, goldsmith, or watchmaker should require to pay a license to sell to the public articles which he may make or get made to his order, the materials he employs in the manufacture of these articles being then as duty free as all other metals are at present. We would submit, therefore, that the gold and silver worker, and seller of articles manufactured of gold and silver, should be as free from legislative hindrance and fiscal penalties as the workers in other metals, or sellers of other goods.

Amendments of Existing Acts.—With regard to the Select Committee's recommendations—Sections (*a*), (*b*), and (*c*), and Hall Marking of Foreign Watches—your Committee's remarks under the head of "Hall Marking," cover what might be said concerning these proposals.

Section (*d*).—Assuming, as the Select Committee appears to do, that licenses and compulsory Hall Marking should be continued, your Committee would point out that to exclude, as proposed, from legal recognition, or for purposes of licensing or regulating the trade in articles of jewellery, as gold, all qualities or alloys of that metal under 16 carats, might be to open the trade to all who may then choose to deal in what at present constitutes the great bulk of articles manufactured and sold as jewellery, and that free from payment for the license now required to sell silver goods and gold and silver jewellery. The extent of the trade, or opportunities of trading on the part of the licensed tradesman, as such, might then be limited, on the one hand, to articles of fine jewellery of 16 carats and upwards, and Hall-marked silver goods; and on the other, to his ability to compete with all persons who deal—very many of whom may have no professional training to fit them for doing so—in the much larger trading assortment of jewellery—viz., all jewellery made of a lower quality of metal than 16 carats, and all silver goods not requiring to be at present Hall marked, and that without payment of any license. The recommendation of the Select Committee, as stated in their report (Sec. *d*), seems therefore objectionable, both as affecting the interests of the trade and the public. A voluntary system of Hall Marking furnishing a guarantee of quality would much better carry out what appears to be the intention of the Select Committee in making this recommendation.

Section (*e*).—Under a continued system of compulsory Hall Marking, for other purposes than the collection of duty, your Committee think that any more direct supervision of the Mint than at present obtains might prove of no advantage, if not hurtful, to the trade, and at the same time afford no additional benefits to the public.

Consolidation of Laws Affecting the Trade.—It would be of great advantage that any amendment of the laws affecting the gold and silver trades should be accompanied by their consolidation into one Act.

After fully considering the whole question remitted to them, your Committee believe that in the interests of all concerned any legislative changes affecting the trade in articles made of gold and silver should include—(1) The abolition of the duties on these metals. (2) The abolition of licenses for permission to deal in articles made of them. (3) The providing for voluntary Hall Marking, under arrangements which will cause Hall Marking to be easily and yet efficiently accomplished upon a uniform system, having for its object the furnishing of a guarantee of quality. (4) The repealing of all old Acts affecting the trade, regarding duties, licenses, compulsory Hall Marking, etc. (5) That any Bill providing for such changes shall also provide for a drawback on duty-paid stocks in hand. Your Committee would also recommend the appointment of a Committee to keep the subject specially in view, and to report from time to time to the company regarding any action which may be proposed or taken concerning this matter.

Note.—The foregoing report having been unanimously adopted by the meeting, the following Sub-Committee was appointed to attend to the subject matter of the report, and to memorialise Government in terms of its recommendations, and take such other steps as may be deemed necessary.

List of Sub-Committee:—

Messrs. William Alexander.
J. D. Davidson.
J. Miller.
F. D. Rait.
Thomas Ross.

Messrs. William Smith.
W. G. Taylor.
D. Todd.
G. Jackson, *Convener.*

Glasgow, *7th July*, 1879.

POLISHING ALUMINUM.

Mons. Mouray recommends the use of an emulsion of equal parts of rum and olive oil, made by shaking these liquids together in a bottle. When the burnishing stone is used, the peculiar black streaks first appearing should not cause vexation, since they do not injure the metal in the least, and may be removed with a woollen rag. The objects in question may also be brightened in potash lye, in which case, however, care must be taken not to make use of too strong a lye. For cleaning purposes benzole has been found best. Objects of aluminum can be electroplated without the least difficulty, and Mouray succeeded in imparting to them a bright white lustre in passing them successively through a weak bath of hydrofluoric acid and aqua fortis. The effect thus obtained is said to be quite surprising.

New American Patents.—An improvement in lock works for clock movements has been patented by Mr. George B. Owen, of Winsted, Conn. It consists in providing the striking cam with a clutch adjustment, so that when the minute hand is turned forward, a pin in the shaft clutches the cam and turns it against the wire lever that actuates the pawl controlling the striking wheel; but when the hand is turned back any distance less than an hour, the shaft is disengaged from the cam.

CORRESPONDENCE.

THE SILVER TRADE.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—The report of the Select Committee is now in the hands of the trade, and I presume it will be generally admitted that the abolition of the duty cannot long be delayed. The serious concern of manufacturers is that, in the interval which must precede legislation, the silver trade will be in a state of paralysis. For this condition of things, manufacturers have only themselves to thank. They were warned, times without number, that the taxation of silver plate was doomed the very moment when a free-trade attack was first made upon it. As was said to me by a distinguished member of Parliament: "Mr. Watherston, you are discharging cannon-shot at the tax; it ought to fall before a drawing-room pistol."

Anyone with a particle of common sense, and with the most limited acquaintance with the history of the free-trade legislation of this country during the last forty years, must have seen that the House of Commons would most certainly condemn such a tax as that under which the trade now suffers.

It would have gone years ago if anyone had had the courage to have raised his finger. The only regret is, that we have suffered so monstrous a hindrance to trade to have prevailed so long after other trades have been released from the pernicious effects of protection. However, "better late than never;" let us be thankful that the time is at hand when taxation of silver-plate will be numbered with many other foolish practices which, through ignorance and prejudice, our forefathers thought fit to indulge in. Their successors, unfortunately, are still to be found in our midst. There was an "Onslow" even upon the Select Committee, showing that the race is not extinct in the House of Commons; but they are now comparatively harmless, being in such a glorious minority that one may well be regardless of their presence.

But, unfortunately, they have power to delay useful legislation. It is true that the flood of public opinion ultimately sweeps them away; but months, sometimes years, are wasted by reason of their obstructive policy.

We shall now see how they will use their present power; fortunately, their own interests suggest an immediate surrender. Let me tell them, if they oppose free trade any longer, they themselves will be the chief sufferers. Shopkeepers now know that the tax is to come off, and they do not know what compensation (if any) they are likely to obtain; the natural consequence is that, if they be wise, they will at once begin to reduce stock. We cannot be sure that the Chancellor of the Exchequer will listen to a proposal for a drawback.

The practical course for manufacturers to adopt is at once to memorialise the Chancellor, asking him to take their case into his serious consideration, so that next April may see the last of the tax, and urging him to allow a drawback upon duty-paid stocks in hand.

I have the honour to be, Sir, your obedient servant,

Edward J. Watherston.

12, Pall Mall East, London, August 1st, 1879.

Rubies are again coming into favour in France and in this country, and will be extensively worn next winter. Prices of these gems are therefore improving.

New German Tariff.—Watches, wholly or in part made with precious metals, pearls, etc., £30 per 100 kilos; articles of jet, amber, meerschaum, ivory, etc., opera glasses, clocks, etc., £6 per 100 kilos.

HINTS TO REPAIRERS.

(*Continued from page 9.*)

In our last we left the fuzee cemented up in the lathe, with the lower pivot out. The next operation is to get the length of arbor and pivot from the old one, then turn down the arbor to fit the hole in the main wheel, and the pivot to fit its hole, leaving just sufficient excess of metal to enable you to grind and polish out all the marks made with the graver, and make the pivot the proper length and finish up the end of it. Now, while it is still up in the lathe, put on the main and maintaining wheels and washer, crowd them up close to the fuzee, and with a sharp-pointed graver mark on the fuzee arbor, through the hole in the washer, for the pin, while the lathe is running. Take them off and take down the fuzee, select a brass ratchet of the proper size, and fit it to the fuzee arbor as described in the last article. Before putting the fuzee back in the lathe again, drill a hole in its arbor for the pin, using a very hard drill, to make which, either turn (the best way) or file up a piece of steel wire to the proper size. If turned up in your lathe, give it a slight taper back from the point, leaving the end just the right size; if filed up, make it a little smaller than the hole is intended to be; and then spread the end of it a little with the hammer, filing both sides flat and slightly tapering towards the point, and making the end the proper shape, only leaving it somewhat thicker than is needed, hardening it in oil or water, and brightening with emery; then take the drill by its extreme point with a pair of plyers or tweezers and carefully draw the temper from the body of the drill until brought down to a blue. The part immediately in front of the plyers will be a straw colour, and the extreme point and cutting edges will not be drawn at all. With such a drill you can easily drill a hole through a fuzee arbor, not crowding it too much, or the end will crumble off. Before commencing to drill, sharpen the drill on an oil-stone, and reduce the end to a proper thickness. In heating steel red hot you are apt to burn the extreme outer surface more or less, and, for that reason, always leave any cutting tool slightly thicker or larger than wanted, so as to be ground down to the proper size. Having drilled this hole and riveted in your brass ratchet, again cement the fuzee up in the lathe and finish the ratchet, as directed before, then take it down and file up the square to a proper size. In doing this it is usual to take the chuck out of the lathe while the fuzee is cemented on the end of it, which enables us to hold it better than we otherwise could, or else we file it up before finishing the lower pivot, in which case it can be held in the pin-vice; lay the upper pivot on the file block and flatten one side with a file, filing down to the groove cut for a guide; turn it over and file the opposite side, getting these two sides parallel, then file up the other two sides in like manner. Next grind each side with oilstone powder and oil on a steel grinder, and finish up as previously described, cutting off the fuzee square to a proper length, and finishing up the end as already directed. It sometimes happens that you have no fuzees in stock, and that your customer cannot wait until you can send to a material dealer for a new one, in which case you must turn him away or else put in a new arbor. It is useless to attempt to put a new square on the old one, as it would soon get loose. You can make a good job by putting in a new arbor, although it is more work and takes longer to do it than to put in a new fuzee. Put the old fuzee up in the lathe, upper pivot out, and with a sharp-pointed graver cut through the snail just far enough from the arbor to clear it, take it out of the lathe, place it in a hollow stake, and with a hammer drive out the old arbor, cement the fuzee up in a chuck the face of which is as large or larger than the fuzee, true it up, and bore out the hole very slightly, and make a shoulder in the upper part, but not very deep; next turn down a piece of steel wire to fit the hole in the fuzee very tight, leaving a shoulder in it to correspond with the shoulder in the fuzee. Next turn down for the lower part of the arbor and pivot, leaving it a little larger than is needed. You can also shape the other end without removing it from the lathe, cutting it off, and making a good centre on the end cut off, and centring the lower pivot before it is cut off. If you are careful and get the measurements properly, it is easy to drill for the pin while it is soft, otherwise you can wait until after you have put it in the fuzee. File up the square while it is soft, then harden in oil or water, brighten with emery, and draw it down to a blue; apply some soft-soldering solution to the arbor where it is to fit in the brass, drive it to its place in the fuzee, and apply some soft solder to both sides, heating it just sufficiently to make the solder flow. If the arbor fits tight a very little solder will make it as strong as if it was riveted in. Now proceed the same as if you were putting in a new fuzee, going through all the various processes of fitting and polishing that you did in that case. I would advise this only in such cases as above indicated, and the charge would be fully as much as for putting in a new fuzee. Of course the lower hole of the fuzee pivot should be examined and treated in the same way as you did the upper hole.

If a new main or fuzee wheel is wanted, select one of the proper size, and to do this, a good wheel gauge should always be found on every watchmaker's bench. Put the wheel up in the lathe on a brass chuck, with cement (shellac is always meant when speaking of cement), true it up by the outside or periphery, with the lower side of the wheel against the chuck; fit the hole to the fuzee arbor, and then fit on the steel maintaining wheel; next turn out the groove for the maintaining spring, reverse the wheel and turn out for the steel washer; drill the holes for the pins of the maintaining spring, filing one of them out so as to give sufficient play for the pin in the end of the spring, polish the wheel while in the lathe with Scotch stone, and then with Vienna lime, or take it off and polish it on a flat block of boxwood, using Vienna lime for the last polish.

The clicks are frequently worn or broken so that new ones have to be put in. For these use the click wire sold by all material dealers, holding it in the pin-vice, and making a tit on the end of it, being careful to get a square shoulder; cut it off the proper length and finish up both sides with a fine file. The end will need a little work on it to give the proper shape to work into the ratchet, having it so that it works free and fits well in the ratchet teeth; then harden, brighten it up on all sides with emery paper, draw it down to a blue, put it in where it belongs, and rivet it in tight enough to hold, and yet have it work easy. Sometimes they are put in without being tempered, but this is only excusable in common work, if excusable at all.

We believe we have gone over about everything that a watchmaker has to do with a fuzee and its appurtenances. Anyone who can do what has been explained in these articles can easily put in a new maintaining wheel, or put on a new steel-washer, without any definite instructions. We shall next consider the centre wheel, pinion, etc.

(*To be continued.*)

Discovery of Roman Coins.—A labourer ploughing in a field at Southwick, on Lord Westmoreland's estate, turned up an earthen jar, which broke in pieces, disclosing ninety-one silver Roman coins, including some of Vespasian, Hadrian, Neva, and Antoninus. The treasure trove, which has been taken possession of by the chief constable, has been reported to the Secretary of State, with a view of securing it for the British Museum.

TRADE RECIPES, &c.

(*Continued from page 6.*)

To give a Golden Colour to Brass.—A mixture of muriatic acid and alum dissolved in water imparts a golden colour to brass articles that are steeped in it for a few seconds.

Solution for Cleaning Brass Chains.—Mix together 1 ounce sulphuric acid, ¾ ounce nitric acid, ½ drachm saltpetre, and 1 ounce rain water, and allow the solution to stand a few hours. Pass the article to be cleaned rapidly through the solution, and immediately wash it thoroughly with rain water. Dry in saw-dust. This process will make old and discoloured chains look as good as new.

Phosphorescent Powders.—Messrs. Pfeiffer, MacCarty and De Sagan, have patented several phosphorescent powders and methods of application to divers purposes. The composition and manufacture of the luminous products and their application without electricity is thus described in the *Scientific American* :—100 parts by weight of a carbonate of lime and phosphate of lime, produced by the calcination of sea shells, and especially those of the genus Tridacna and the cuttle fish bone, are to be intimately mixed with 100 parts by weight of lime rendered chemically pure by calcination, and add 25 parts by weight of calcined sea salt; from 25 to 50 per cent. of the whole mass of sulphur, which incorporate therewith by the process of sublimation, and from 3 to 7 per cent. of colouring matter in the form of powder composed of mono-sulphure of calcium, barium, strontium, uranium, magnesium, aluminum or other minerals or substances producing the same physical appearances, *i.e.*, which, after having been impregnated with light, become luminous in the dark. After having mixed these five ingredients intimately, the composition is ready for use according to different methods of application. For certain cases, and more especially for augmenting the intensity and the duration of the luminous effect of the composition, the patentees add a sixth ingredient in the form of phosphorus reduced into powder, which is obtained from seaweed by the well-known process of calcination.

As to proportion, it is found that the phosphorus contained in a quantity of seaweed, representing 25 per cent. of the weight of the composition formed by the five of the above-named ingredients, gives very good results. The phosphorescent powder thus obtained and reduced into paste by the addition of a sufficient quantity of varnish, such as copal, may serve with advantage for illuminating a variety of objects, by arranging it in more or less thick coatings upon a plate of metal, wood, glass or other material covered by a transparent glass.

These powders are also employed for manufacturing solid objects generally made of cellulose, paper waste, papier maché, artificial ivory, and other materials of a similar nature, by sprinkling the surface of these objects, or only certain parts of the surface (still damp or moist) which are usually exposed to light, and by compression in moulds or otherwise, in order to incorporate definitely the phosphorescent powders into the surfaces. The amount of powder applied should not exceed the thickness of a thin sheet of of cardboard; it may be employed either for coating the whole surface or certain fractions thereof, so as to produce various designs, inscriptions or effects. For this application various powders are also applied, which contain different colouring matters, so as to produce effects of various colours.

(*To be continued.*)

THE BIRMINGHAM JEWELLERY TRADE.

IMPORTANT ALTERATIONS IN THE BUSINESS SYSTEM.

For years the jewellery trade has been carried on upon most unsound commercial principles, and there can be no wonder that under the circumstances those engaged in it should complain of its gradually decreasing lucrativeness. They unanimously deplored also the—we might almost say illegitimate—way in which the business is conducted, but none came forward with sufficient moral courage and integrity to lift it from the slough of despond into which it has fallen. Among other evils of the system, that of giving long credit is undoubtedly the worst. Credit is given for twelve months, eighteen months, and even two years almost as a regular custom of the trade, thus giving every advantage to the unscrupulous trader. The one idea of the shopkeeper appears to have been the length of credit he could obtain, and in order to catch the large profits that must be affixed to credit transactions, the merchant was induced to run the greatest risks, thus to a great extent reducing the trade to rash speculation and a dealing in discounts. At length a circular has been issued by one of the leading firms, in which their customers' attention is drawn to the growing evils of long credit, and the mischief attending the pernicious bill system. Messrs. Abrahams Brothers, merchant jewellers of Vyse Street, state in this circular that as wholesale jewellers of twenty years standing they have ever regretted the ready facility with which "men of straw" have obtained credit, to the loss and injury of legitimate dealers. Statistics show that the losses incurred among provincial jewellers for the last five years, have reached the enormous sum of Two Hundred Thousand Pounds per annum, which amount has to be made up from the profit of those who struggled against unfortunate or dishonest competitors, as in no other branch of the trade are the losses so disproportionately large in comparison with the returns. Messrs. Abrahams have found a remedy for this, and a remedy which every man of straight-forward commercial principles will hail with gladness. They have determined not to extend their present credit connection, and to execute all future orders intrusted to them upon strictly net cash terms, charging manufacturers' exact prices, allowing their discounts, deducting same from invoices, and charging only, after such deductions, five per cent. as merchants' commission and profit. The benefit to the manufacturer of a cash system is obvious, while to the shopkeeper it makes this difference, that instead of having to pay from ten to fifty per cent.—according to his standing with the manufacturer with whom he deals—upon manufacturers' prices, he will pay by a fixed rate. It is the credit system which has sapped the life and energy out of the jewellery trade, and although any attempt to abolish or even to limit it will at first meet with opposition from certain of the trade, in the end, if universally followed, it must prove beneficial to everyone connected with the business. Messrs. Abrahams deserve praise for their hardihood in attempting to break through the trammels of the credit system—*The Birmingham Daily Gazette.*

Importation of Clocks and Watches.—In May last, 85,915 clocks, valued at £50,123, and watches to the amount of £41,487, were imported.

Competition for Going Barrel and Stopwork.—The silver medal of the Turners' Company was awarded to Mr. Walter William Chalfont, of 6, Great Percy Street, W.C., and presented to him at a court held by the company on the 5th of June. The successful exhibit is said to be "a contrivance full of ingenuity, originality, and usefulness, such as promises to become an incorporate idea in the watchmaking of the world."

ON THE COMPENSATION OF CLOCKS, WATCHES AND CHRONOMETERS.

By EDWARD RIGG, M.A.,

Assayer in the Royal Mint.

(*Concluded from page 5.*)

A BI-METALLIC helix is adapted near the extremity of the ordinary rim, and carries a collar, in which a weight is screwed, so as to be adjustable. The motion of this weight with a change of temperature, is the resultant of that due to the rim and helix, and its effectiveness depends on the distance between the middle of the helix and the centre of gravity of the weight; this, of course, is variable.

Although carried out in a very different manner, the compensation weights patented in 1843 by Lund, and that more recently proposed by Vissiere involve a similar principle. Lund's weights are too complicated for brief description, but it may be mentioned that they appear to be far less sensitive to centrifugal force than do those of Vissiere. Without entering into the details of construction of the latter, it will suffice to say that the weight is carried on a small divided bi-metallic ring attached by an arm to a block that can be set in any position along the bi-metallic rim of the balance. The weight can be moved along the ring for adjustment, and the entire system forming the weight can be rotated about the centre of this ring. It is evident that the motion of the weight is the resultant of that due to the two bi-metallic strips, and the adjustment consists in so co-ordinating these, that the inward motion is increased, and the outward diminished.

Another balance of this class that remains to be noticed, namely Loseby's, involves the use of mercury. This is contained in two thermometers curved towards the centre of the balance, and some years ago satisfactory results were secured by its inventor; but mercury and glass are very objectionable, and are now never employed.

A balance acting on an entirely different principle to any of the above has been recently invented by Woerd in America. It is characterised by the total absence of the ordinary bi-metallic strip. This is replaced by a band of steel, which is cut near the junctions with the diametral bar; saw-like indentations extend across the entire band, and these spaces are filled in with a highly expansive metal. The uncut portion of the steel, carrying screws, is thus caused to move to or from the centre by an amount depending on the number of teeth; the inventer, moreover, claims that its amount of inward motion gradually increases in accordance with the requirements of theory—in other words, that the tension of the spring and moment of inertia of the balance bear the same ratio to each other in all temperatures—but it is not evident why such should be the case.

Finally, a modification of the ordinary balance has just been suggested by Saunier. The idea seems well worth carrying out, at any rate, on an experimental balance, and he expresses a hope that some watchmaker will make such a trial. The two halves of the diametral arm, instead of forming parts of a straight steel bar, are semicircular bi-metallic pieces, with the brass on the inside face. They are so placed that changes of temperature increase the movements of the compensation weights both in heat and cold. It seems certain, from a consideration of the combination of movements, that the effect of such an arrangement will be to produce a motion of the weights more directly towards the centre in heat, and less so in cold, thus materially reducing the middle temperature error. With care the rigidity would be equal to that of the ordinary form, the difficulty of construction need not be great, and all the adjustments would be unaltered.

The impossibility of securing perfect compensation with the ordinary balance induced many attempts to be made to carry out the principle of rectilineal compensation, as illustrated by Le Roy's mercury balance. Hardy proposed to support two weights at the extremities of a flat bi-metallic strip, and this system was elaborated by Dent, and is the foundation of some of the more recent forms of balance.

The rectilineal movement is usually brought about by joining the two metals, so that the plane between them is at right angles to the balance-staff instead of parallel, as in the ordinary construction. The balance being adjusted for a mean temperature, any application of heat will cause the strip to bend upwards, since brass is below, and the converse will be the case in cold. Now, the amount of the motion to or from the centre is determined by drawing a perpendicular from the centre of gravity of the weight, which is carried by the upright, to the horizontal; and, by a well-known geometrical principle, this is less with a given motion downwards than for the same motion upwards. Dent's balance, known as the "staple balance," is on this system. The application of heat will cause the two staples to open out, since they are formed of the usual metals, brass and steel, and the weight will thus be raised, the compensation due to the main arm taking place at the same time. The result will be that the movement inwards is still further increased, as compared with that outwards; the ratio subsisting between the two must be varied by a change of the length or thickness of the staples. Some excellent chronometers are fitted with this balance, but it is difficult of construction, not easily poised, and liable to be affected by centrifugal force. Hartnup, of the Liverpool Observatory, proposed the following form, which was very successful in the hands of Shepherd, of that town. Its mode of action is not so evident as is that of Dent's; but a few words of explanation must suffice. The entire balance is formed of bi-metallic strips. In the central bar, brass is uppermost, but in the other two straight bars, steel. The segments forming the rim are of steel and brass, with their junction inclined at an angle of about 45° to the plane of the balance. The balance, however, is difficult of construction, and has not been successful with other makers.

The skew principle of the balance just alluded to is also taken advantage of in Kullberg's balance, of which there are two or three varieties. In his low-rim balance the centre bar is formed of brass and steel, the former uppermost. Two semi-circular bi-metallic rims are attached at opposite ends; they are made of considerable thickness, in order to bring the weights near the extremities. Another balance of Kullberg's design, known as the flat-rim balance, has given excellent results. It is circular in form, and the rim is a flat bi-metallic strip of the usual metals.

The last balance I shall refer to is that of Winnerl, which has been recently invented. Three arms are employed, as in Hartnup's, but the central one is entirely of steel, and therefore remains flat in all temperatures. Bi-metallic strips of brass and steel, in the proportion recommended by Villarceau (0·43 mm. to 0·32 mm.), are attached to its ends, and these carry at their extremities inclined supports, on which conical platinum weights are screwed. The exact inclination of the arms must be adjusted for each make of chronometer and balance-spring. The adjustment is said to be extremely simple, and not to involve the removal of the balance from the instrument. The rates at two extremes are first brought into accordance by raising or lowering the weights, and then, for an increase at a mean temperature, the inclination of the support is diminished, and conversely with a loss. The timing screws are carried on a separate arm. Caspari has discussed the efficiency of this balance, and concludes that it is competent to secure a perfect compensation, and does not interfere with the isochronism of the spring. He has further ascertained that the motion of the weight is the resultant of two motions, one proportional to the temperature and the other to the square of the temperature.

Although this seems to offer some advantages it cannot be regarded as entirely satisfactory; for there is a great mass of metal at the centre, and the poising can never be as easy as in a balance of circular form. Kullberg has, moreover, pointed out that the use of screws for joining the bars is a grave objection.

The consideration of these few specimens, selected from the vast number of balances that have been proposed as means of securing an exact measure of time, shows that there are still several points far from being satisfactorily solved.

One point that cannot fail to be noticed is, that the adjusting of a chronometer, even when performed by the very best workmen, should require almost as many trials, and extend over as long a period, as it did in the days of Arnold and Earnshaw. Surely it is not unreasonable to expect that some of the ingenuity and skill that are devoted to the designing of auxiliaries might be expended in devising some more expeditious means of adjusting the primary compensation, and thus both reduce the cost of production of high-class work, and diminish the risk of straining the balance-spring or damaging the mechanism, which no amount of care can always avoid. It does certainly appear remarkable when labour is being diminished as much as possible in all the mechanical arts, that chronometer makers should be so far behindhand in this matter.

Another point that is worthy of notice, illustrated in a marked manner by the annual reports of chronometer trials at Greenwich, is the fact that no one form of balance has succeeded in establishing itself as invariably better than others; and even balances that are known to be among the best often figure low in the list. The frequency with which this is to be noticed is hardly explicable, unless we allow that circumstances influence the rate which are beyond the control of any workman, and that, when the performance of a chronometer is exceptionally good, the path of the compensating weights happens to accord with the several influences by which the movement of the balance is modified. The composition of the brass, the fineness of steel, degree of hammering, smoothness of acting surfaces, play of pivots, constrained molecular state of metals employed, and above all, the nature of the oil—all these points may be perfectly satisfactory for compensation up to a certain limit, but beyond that each may have an infinitesimal effect which cannot be isolated or neutralised; and thus a balance whose compensation is perfect in one instrument may not give satisfaction in another, although made by the same workman.

In astronomy—that most exact of all the sciences—it is impossible to avoid even errors of observation, or differences between the actual time of a phenomenon and the period at which it is appreciated by the senses, except by a mathematical device involving probabilities, such as the method of least squares; it is not unreasonable to conclude, therefore, that a point must be reached at which the errors of every machine that is the result of human skill must be neutralised in some similar manner; and the tabulation of chronometer errors is a case in point.

The remark of Sir John Herschel* with regard to astronomical instruments is peculiarly applicable to chronometers, where so many actions require to be co-ordinated; and it might be remembered with advantage by many who introduce novel balances. "Human hands or machines," he says, "never formed a circle, drew a straight line, or erected a perpendicular, nor ever placed an instrument in perfect adjustment, unless accidentally, and then only during an instant of time."

The variation that every auxiliary is designed to correct amounts to only the $\frac{1}{648000}$th part of the period measured for each degree (Centigrade) change of temperature, and this comes very near the limit of sensibility of our best chemical balances, and is even almost comparable with Whitworth's wonderful machines for measuring lengths, &c.; instruments that are characterised by great simplicity, and subject to exceptionally few interfering causes. On the other hand, it must be admitted that the remarkable uniformity observed in the error of all chronometers with balances of the ordinary construction, tends to prove that the above-mentioned influences are of secondary importance; but they certainly do stand in the way of absolute perfection. It becomes a question, then, whether a recognised and comparatively large error, that can be allowed for, is to be preferred, or a so called perfect compensation, that we feel convinced can never be attained except by accident, and is liable to be destroyed by the rough motion to which a chronometer at sea is always subject. No one would hesitate to select the former. Recent improvements in the pendulum have tended as much towards reducing the cost of construction as to increasing the efficiency, and it would be well if chronometer-makers would follow this example. What is now wanted, as already observed, is a means of materially diminishing the time required for adjustment and poising, and, consequently, reducing the cost; and the inventor of a really efficient and practicable method might rely on benefiting both himself and the trade generally. Too much stress cannot be laid on the necessity of solidity of construction, which is so sadly wanting in a vast number of the improvements that have been proposed; subject to these conditions, any invention that tends to diminish the middle temperature error should be welcomed, but such reduction is not worth having at the sacrifice of solidity.

The Astronomer-Royal, some years ago, pointed out that the chronometers received at Greenwich were very generally found to be unsatisfactory as regards the final adjustment of the compensation, and he, at the same time, suggested the best method that has been hitherto invented for facilitating it. Two small weights are carried at the end of an arm held by friction on the balance-staff, at the extremities of two light steel springs, and these weights are always in contact with the rim. By turning the arm to the right or left, the space through which they move is altered, since each point of the rim moves inwards through a different distance; the effect is thus the same as if the mass of the compensating weights were modified, and the poising of the balance is not disturbed. This appendage must not be regarded as in any sense an auxiliary; it is merely intended to serve the above-mentioned purpose, and is stated to be so easy of application, that the final adjustment is now often made at the Observatory.

Very little need be said as to the effect of barometric variations on the rates of chronometers. The question was studied by Jurgensen, and he concludes that their influence is almost inappreciable, absolutely vanishing when the balance-spring is so adjusted that a reduction of the arc of vibration by 150° corresponds to a gain of 5 or 6 seconds per day. More recently, Villarceau has calculated that, if the resistance opposed by the air to the motion of the balance varies as the square of the velocity, it has no appreciable effect, and this has been confirmed by observation.

In concluding, it may be noticed that no less than five of the physical properties of matter must be taken into account in designing an arrangement for compensation. These are:—Dilatation or expansion by heat; conduction or the power of transmitting heat from a colder to a hotter portion; specific heat, as on it depends the rapidity with which the pendulum (or balance) assumes the temperature of the surrounding medium; density, or the weight of a unit of mass; and elasticity at varying temperatures, especially in the construction of balances.

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* "Outlines of Astronomy," Eleventh Edition, p. 80.

While theory is always a valuable guide to the practical observer, a question of such delicacy as the absolute adjustment of a chronometer must be solved by experiment; for, as we have already shown, a motion of the weights towards the centre, such that the square of the radius of gyration is inversely proportional to the temperature, will only suffice to maintain the rate uniform on the assumption that the tension of the spring is the sole variable, varying in inverse proportion to the temperature. But we also have changes occurring in the consistency of oil, diameter of balance, motive force, &c., and these cannot be regarded as having precisely the same effects in different cases. It necessarily follows that no balance can exist that is universally applicable, and the only balance capable of such absolute adjustment would be one in which the ratio of the movements per degree could be altered at will throughout the entire range of temperature between any two given points, and even then the effects of oil, &c., would, in all probability alter in time. Such a balance has yet to be invented, and, until one exists that satisfies both the demands of theory and practice, it is far preferable to resort to the method already referred to, of tabulating errors, after having carefully adjusted any balance of simple construction, that can be depended upon to behave always in the same manner when under identical conditions.

THE SILVER DUTY AND HALL-MARKING QUESTION.

THE following letter on the above subject appeared in the *Daily Chronicle* :—

Sir,—May I beg the favour of a little space in your paper on the "Silver Question," which I think will soon be one of the most disputed problems of the day? Living far away in the country, where perhaps a clearer view can be taken than by those on the spot of the doings of the silversmiths' trade in London, it has greatly surprised me to see the apathy of the greater part of those engaged in this business, concerning the proceedings of the Committee of the House of Commons on the silver duty, and the hall-making question, and the movement to free them from the trammels of the same. They all seem to forget how interested they all are in this question, and of what vital importance it is to them to be on equal terms with all foreign competition. The trade seems to be asleep, and not at all aware how it is clogged and hampered; and it must be only the dread of foreign and the fear of home competition that make the few English manufacturers now in this trade to wish to go quietly sleeping on, trusting in their close monopoly here as their best safeguard against all encroachment from without, forgetting that they are going down and down in the scale of progress and improvement.

At present the whole battle seems to be fought by Mr. E. Watherston, of Pall-mall, but the time must come when others will join in this movement; and the day cannot be far distant when it will be felt how much is owing and due to that gentleman for his courage and zeal in fighting this battle alone, to free the only duty-ridden manufacture in England, from being one of the most tramelled trades to be what it ought to be—one of our noblest industries. As it is now, one has first to pay a heavy license every year for permission to sell an article having a tax on it of one-third of its real intrinsic value. This license is given in the curtly style of those almost conferring a favour, and then you have to put up with the little pleasantnesses of paying this tax.

And yet the public, and even some of the trade, think it is best to have these burdens to secure an article of tolerably pure silver, and would not like a voluntary hall-marking for silver, forgetting that it is quite voluntary as to hall-marking for gold? And yet who ever cried out about gold being bad because not necessary to mark it, those who voluntarily mark their gold having by far the best name? And so it would be with silver. Once let it be free for everyone to mark it or not, as he pleased, and then, instead of one maker, there would be twenty, and everyone would bring fresh life and fresh energy to it. Then with silver, as with gold at present, the man putting the best mark on all his things would command the best name.

I would propose that all the present processes of assay should be done away with; that everyone should make what quality he pleased, but should be compelled to put his mark on it as to the quality he professed it to be, having the quality expressed by tenths—thus it could be 7-10ths, 8-10ths, 9-10ths, as he chose, as to purity—and then he should be liable for adulteration exactly the same as the seller of any other adulterated article. The voluntary hall-marking should be readily done in London, or at any of the present country halls, by merely the hall-mark being attached as a guarantee of the maker's mark; and in the country towns, where there are no halls, the excise, or the police, should be able to attach the Government stamp upon the payment of a small fee, all the present labour of assaying and collecting the tax being swept away. Should anyone doubt the article, let him, or the public analyst, have it assayed, and if not up to the quality put on it, let the offender be prosecuted, just the same as the man that sells bad tea or bad milk.

There would be then some prospect of and a fair chance for the development of a trade now at the very lowest ebb, in an art point of view, and there should be in time makers of silver goods all over the country. Almost every other article can be made anywhere, but at present, from the clogs and hamperings of the trade, it is impossible to make anything in silver, excepting in a very few places in England. A steam-engine can be made in hundreds of places in this part of the kingdom, but a tea-spoon cannot be made in more than about five places. Surely the former is much more difficult to make than the latter, and the fact is a singular anomaly, the reason for which is worth trying to find out.—I am, Sir, yours obediently,

John W. Singer.

Frome, Somerset, July 22nd.

ALUMINUM SOLDER.

MONS. MOURAY employs five different solders, being different proportions of zinc, copper and aluminum The copper is melted first, the aluminum is then added in 3 or 4 portions; when the whole is melted it is stirred with an iron rod. The crucible is then withdrawn from the fire, the zinc gradually stirred into the mass, and the whole poured into ingot-shaped moulds previously wiped out with benzine. The parts given in the following proportions are by weight:—

1.—80 parts zinc, 8 parts copper, 12 parts aluminum.
2.—85 ,, 6 ,, 9 ,,
3.—88 ,, 5 ,, 7 ,,
4.—90 ,, 4 ,, 6 ,,
5.—94 ,, 2 ,, 4 ,,

The selection of either of the above solders depends upon the nature of the object. In order to quicken its fusion in the metal, a mixture of 3 parts balsam of copaiba and 1 part Venice turpentine is made use of; otherwise the operation is performed in exactly the same manner as in the brazing of other metals. The aluminum solder is spread without delay on the previously heated surfaces to be fastened together. In heating, the blue gas flame or the turpentine blast lamp is employed. The more and oftener the solder is spread over the surface, the better it is.

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Mr. J. H. Johns is the only authorised traveller for this Journal.

Receipts for subscriptions will only be sent when asked for, and on receipt of postage stamp for such purpose.

PATENTS.

Notices to Proceed.

738. William Robert Lake, of the firm of Haseltine, Lake and Co.' Patent Agents, Southampton Buildings, London, has given notice in respect of the invention of "Improvements in the manufacture of chemically prepared paper, cloth, wood, and similar materials for enclosing or covering silver and other metal to prevent the tarnishing of the same."—A communication to him from abroad by Joseph Torrey, of the City and State of New York, United States of America.

878. Frederick Arthur Walton, of Birmingham, in the County of Warwick, manufacturing jeweller, has given notice in respect of the invention of "Improvements in scarf rings or scarf slides for fastening scarfs and other articles of dress."

879. Frederick Arthur Walton, of Birmingham, in the County of Warwick, manufacturing jeweller, and Thomas Shaw, of Birmingham aforesaid, tool maker, have given notice in respect of the invention of "Improvements in ladies' dress holders or dress suspenders."

1397. Hermann Krupp, of Vienna, Austria, has given notice in respect of the invention of "Improvements in or preparatory to electro-plating."

933. Etienne Mathurin Léon Maxant, of the city of Paris, in the republic of France, has given notice in respect of the invention of "Improvements in invisible clock-winding mechanism with permanently located keys."

1955. Henri Robert, of 34, Clerkenwell Road, in the county of Middlesex, watchmaker, has given notice in respect of the invention of "Improvements in watches."

1322. Antoine Léon Cornu, watchmaker, of 3, Bennett Street, Fitzroy Square, in the county of Middlesex, has given notice in respect of the invention of "Improvements in machinery for converting striking clocks into chime clocks."

Patents on which the Stamp Duty of £50 has been paid, and Dates of their Production for Certificate.

2892. Thomas Morgan, Secretary of the Inventors' Patentright Association, Limited, 21, Cockspur Street, Charing Cross, in the county of Middlesex, for an invention of "Improved watch keys."—A communication to him from abroad by John S. Birch, of New York, United States of America.—Dated 14th July, 1876.

2913. Henry Matthew Robottom, of Liverpool, in the county of Lancaster, for an invention of "Improvements in the manufacture of keyless watches."—Dated 17th July, 1876.

Applications for Letters Patent.

2717. Francis Hope, of Birmingham, in the county of Warwick, manufacturer, for an invention of "Improvements in shirt and other studs, solitaires, and other dress fastenings and ornaments."—Dated 4th July, 1879.

2743. William Henry Read, of White Street, Coventry, in the county of Warwick, for an invention of "Improvements in keyless watches." —Dated 5th July, 1879.

2989. John Price Hunt, of Birmingham, in the county of Warwick, jeweller, for an invention of "Improvements in or relating to earrings, ear-studs, necklets, chains and bracelets, applicable to other ornamental and useful articles or appendages."—Dated 23rd July, 1879.

3017. Alexander Melville Clark, of 53, Chancery Lane, in the county of Middlesex, patent agent, for an invention of "Improvements in keyless watches."—A communication to him from abroad by Pauline Gontard, of Cortébert, Switzerland.—Dated 24th July, 1879.

Patents which have become Void.

2865. Albert William Jones, of Camden Town, in the county of Middlesex, and Harvey Chamberlain, of Hamsell Street, in the City of London, for an invention of "An improvement in solitaires and studs."—Dated 13th July, 1876.

2926. Herbert John Haddan, of the firm of Herbert and Company, patent agents, of 67, Strand, in the city of Westminster, Civil Engineer, for an invention of "Improvements in chronometer escapements." —A communication to him from abroad by F. Herman Voigt, of Buffalo, State of New York, United States of America, watchmaker. —Dated 18th, July, 1876.

Grants of Provisional Protection for Six Months.

2490. To Jacob Merzbach, of Holborn Viaduct, in the city of London, for the invention of "An improved clock movement."—A communication to him from abroad by Oreste Blanchetti, of Paris, France.

Patent Sealed.

3601. James Witherspoon, of Fox Court, Brook Street, Holborn, in the county of Middlesex, for an invention of "Improvements in the cases or frames of barometers."—Dated 11th September, 1878.—[Time extended to 1st July, 1879.]

1744. Arthur Willmore Pennington, of St. Martin's Place, Birmingham, in the county of Warwick, jeweller, for an invention of "A new or improved mode or means of producing ornamental designs in colour upon brooches, earrings, pins, bracelets, and other articles of ornament and utility made in metal or alloys of metal."—Dated 2nd May, 1879.

2797. Alexander Melville Clark, of 53, Chancery Lane, in the county of Middlesex, patent agent, for an invention of "Improvements in keyless repeating watches."—A communication to him from abroad by Ami Louis Junod-Pattus, of Paris, France.—Dated 8th July, 1876.

2078. Frederick James Ritchie, of the city of Edinburgh, Scotland, watch and clock maker, for an invention of "Improvements in sympathetic clocks."—Dated 10th July, 1872.

Patents Granted in Foreign States.

German Empire.

6176. J. Schlenker, of Schwenningen, for "A repeating clockwork."—Dated 28th November, 1878.—Class 83.

6429. M. Winterhalder & Hofmeier, of Schwärzenbach, for "A suspension spring in regulators and time-keepers."—Dated 28th February, 1879.—Class 83.

6523. J. Reckendorfer, of New York, for "A pencil-case."—Dated 15th February, 1879.—Class 70.

Belgium.

48,293. J. Walzer, for "Improvements in the construction of watches." —Dated 24th May, 1879.—French Patent, 12th May, 1879.

48,387. A. Straus, sen., of Liége, for "A single microscope."—Dated 4th June, 1879.

48,433. A. Lion, for "Jewelry such as bracelets, collars, &c., and its manufacture."—Dated 9th June, 1879.—French Patent, 31st May, 1879.

France.

128,481. Wimmerlin, for "A balance with double safety escapements."—Dated 16th January, 1879.—Class 12.

128,535. Mandl, for "Manufacturing earrings with spring fasteners."—Dated 18th January, 1879.—Class 17.

128,584. Ganster, for "Improvements in lighting and extinguishing gas-burners, and in apparatus belonging thereto, partly applicable to clocks and other like time-keepers."—Dated 21st January, 1879.—Class 12.

128,649. Mascart, for "Refining gold and silver substances."—Dated 25th January, 1879.—Class 8.

128,652. François, for "A chronometer."—Dated 25th January, 1879.—Class 12.

128,750. Viatour, of Paris, for "Gnomonic compasses for tracing sun-dials."—Dated 30th January, 1879.—Class 12.

128,763. Thomas, for "Improvements in clock work."—Dated 30th January, 1879.—Class 12.

129,043. Pierre, for "Serpent bracelets."—Dated 10th February, 1879.—Class 17.

129,045. Japy, Brothers, & Co., for "Clock-cases."—Dated 10th February, 1879.—Class 12.

129,112. Vauvilliers, of Paris, for "Hollow solderless wedding-rings of plated gold or silver."—Dated 13th February, 1879.—Class 17.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Tondo, Giovanni, trading as G. Tondo & Co., 71, Cornhill, watch importer. June 23. C. Butcher, sol., 156, Cheapside.

Austin, Frederick Charles, Union Street, Ryde, watchmaker. July 1. F. W. Henry, sol., 7, Furnival's Inn, Holborn.

Burton, Frederick, Market Place, Leicester, Jeweller. July 12. A. Peel, sol., 83, Colmore Row, Birmingham.

Dilger, Albert, Bolton Street, Bury, watchmaker. July 7. J. Haslam, sol., Bury.

McElroy, Francis, 3, Corporation Street, Manchester, and 5, Lime Street, Longsight, optician and electrician. July 8. W. F. Farringdon, sol., 49, Princess Street, Manchester.

Phillips, George Anderson, Stepney Street, Llanelly, jeweller. July 9. J. Price, sol., Haverfordwest.

Winter, Charles Edwin, Spring Bridge Road, late High Street, both Ealing, jeweller. July 9. W. Philp, sol., 37, Walbrook.

Darlington, Thomas, Bucknall New Road, Hanley, watchmaker. July 16. G. Lawrence, sol., Hanley.

David, Herman, Ely Place, London, and Northampton Street, Birmingham, diamond merchant (sep. creditors). July 19. At Inns of Court Hotel, High Holborn, Aug. 6 at 3. A. Leslie, sol., 34, Conduit Street, Bond Street.

David, Herman, and Leon David, 29, Ely Place, London, and Northampton Street, Birmingham, diamond meachants. July 19. At Inns of Court Hotel, High Holborn, Aug. 6 at 2. A. Leslie, sol., 34, Conduit Street, Bond Street.

David, Leon, Ely Place and Russell Square, London, and Northampton Street, Birmingham, diamond merchant (sep. creditors). July 19. A. Leslie, sol., 34, Conduit Street, Bond Street.

Hicks, Jno., High Street, Tunstall, watch and clock maker and working jeweller. July 15. J. A. Alcock, sol., Tunstall.

Orams, Jeremiah Kossuth, Chelmsford, jeweller. July 18. At — Leeming's, acct., 10, Coleman Street, London, Aug. 11 at 12. R. Blyth, sol., Chelmsford.

Carr, John Wm., trading as J. W. Carr, junr., Commercial Street, Leeds, silversmith. July 19. At Middleton & Son's, sols., Leeds, Aug. 8 at 2.

Elliott, Thomas, Market Place, Preston, jeweller. July 23. At C. T. Taylor's, sol., Preston, Aug. 13 at 12.

Stebbing, Joseph Ranken, Bridge Road, Southampton, optician. July 23. At Stocken & Jupp's, 6, Lime Street Square, London. Aug. 13 at 3. W. J. H. Bull, sol., Southampton.

Dividends.

Darling, Adolphus (Liq.), Mile End Road, jeweller. 1st. div. 5/- A. Prevost, 176, Mile End Road.

Pinnel, Jane (Bkt.), Red Cross Square, silversmith. 1st div. 1/6¼ Wednesday next and two subsequent Wednesdays, between 11 and 2. P. Paget, Bankruptcy Court, Lincoln's Inn Fields.

Adjudications of Bankruptcy.

Allen, Wm. Arthur, Duke Street, Cardiff, jeweller. July 4. Langley, Reg.

Trustees Appointed.

Marston, Walter S. (Bkt.), Coventry, watch manufacturer. Tr., M. Michael, Coventry, watch manufacturer.

Bamber, Jno. W. (Bkt.), Church Street, Preston, watchmaker. Tr., T. Thorp, Preston, Accountant.

Dissolutions of Partnerships.

Grimmett & Timmins, Hylton Street, Birmingham, jewellers, &c. June 25.

Johnson, R. M. & Co., Sheffield, silversmiths. June 26. Debts by Bernard Lucas Johnson.

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CONTENTS.

	PAGE
Horology	27
Hall-Marking Agitation in Dublin	28
Greenwich Time Ball	28
Practical Instructions to Jewellers, Silversmiths and Electro-platers	29
Prices Current for Gold and Silver	29
A New Time Signal	30
Jewellery	31
The Report of the Goldsmiths' Company of Glasgow	32
The Birmingham Jewellery Trade	32
Molecular Oscillations	32
Curiosities of Clocks and Watches	33
Bronzes	34
Hints to Repairers	35
Precious Coral	36
Trade Recipes, &c.	37
Importations of Clocks and Watches	37
Patents	38
Monthly Record of Bankruptcies	39
The Prince Imperial's Watch	39
Gleanings	40
Directory	ii
Advertisements	i-x

No. 52.—Vol. V.] SEPTEMBER 5, 1879. [Subscription, 5s. per Annum. Post Free.

HOROLOGY.

(*Continued from page* 16.)

XLIV.—Correct Epicycloidal form of Wheel Teeth.

It is sufficient to have been occupied somewhat with mechanical horology to appreciate the importance or effects of a good or bad gearing. The quality of action desirable in a wheel and pinion is expressed in the following three points:—Uniform transmission, proportionally equal velocity, and an action free from friction. This triple desideratum in a gearing can be obtained only on condition of combining the mathematical relations of the diameters with a correct form of the teeth. The foregoing embraces theoretically all the points in question, and it may be mentioned that practical solutions have been found for nearly all these problems, with more or less accuracy for the last mentioned—the good form of the teeth. We shall occupy ourselves only with this last question, which of itself deserves the attention of the most scientific minds. We will not here dwell on the theory of the epicycloid, according to which the configuration of the teeth of wheels and pinions ought to be. What is certain is, that in fine gearing, such as is in watches and other accurate mechanisms, the curves or rounding of the teeth ought to be made with extreme geometrical precision, without which their functions will be worse in proportion as the motive power is weaker.

Various tools for obtaining this all-important object have been invented and applied, such as the ordinary rounding-up fraise, Saunier's rounding-up tools of precision, and Ingold's fraises. The ordinary fraise, particularly the one called an endless screw, is a very ingenious invention, and of very expeditive application, but nothing which guarantees exactitude or good work. In fact, how are these tools so generally employed made that are to give to the teeth of wheels their proper shape? At the hazard of the hand, according to the notions of the workman, of a shape to satisfy the eye, but in no degree on geometrical principles. By their means production is rapid, but the market is also stocked with an abundance of defective wheels. Saunier's rounding-up tool of precision is an admirable instrument, realising, so to say, the dream of a geometrician; it takes hold of the tooth, guides it to the fraise, and carries it before the latter according to the theoretical curve of the rounding necessary, which is the dividing machine identified with the rounding-up tool. This invention is too little known, and if manufacturers would make more use of it, there would be nothing but perfect teeth in wheels. Notwithstanding its incontestable merit, this machine does not enter into the usual work.

Ingold's fraise is an idea exactly in conformity with the demands of the problem enunciated above. This tool is nothing else than a pinion, the spaces and sides of the leaves of which are finely cut like a file. Placed into gear with a wheel to be cut it gives to the teeth their form by filing them according to the theoretical curve. This would appear to solve the problem. After this invention we might have thought that there was no need of seeking for another, and the question arises why this tool is not in the hands of every workman. Probably the greatest obstacle to its becoming generally used is the difficulty to get a complete assortment. For every dimension of teeth a separate fraise is necessary, and as the number of the dimensions of teeth is infinite, it follows that this tool cannot be completed—at least, it would become enormously expensive.

From a French pamphlet* we translate the description of a new instrument for giving to the teeth of wheels the proper epicycloidal form. For the repairer it would appear to be just what is needed to enable him to correct bad gearing, resulting from improperly shaped teeth, as well as for replacing a new wheel; it is at the same time simple, inexpensive, rapid and theoretically correct in its operation. The rounding-up cone, C.J.B.Z., the instrument which we desire to bring to the notice of watchmakers, is a tool of the same kind as the preceding one. It consists of a small cone of steel-toothed, similar to a pinion, and drilled through, in order to be placed opposite a loose arbor. The taper of the cone is one-twentieth ($\frac{1}{20}$) of a millimetre for every millimetre of length; or for a length of twenty millimetres there is one millimetre difference between the diameters of the large and small ends. This proportion, perfectly suitable for the thin wheels used in watches, is reduced to one-half in the cones destined for the larger work of clocks, so that the taper of the cone is only one-fortieth ($\frac{1}{40}$) for every millimetre in length. Eight cones form a complete assortment, comprising, without the least exception, all the sizes of teeth existing, from the smallest to the largest watches. In other words, this assortment of eight pieces represents, without any interruption, all the imaginable dimensions of teeth, from a pitch of one-tenth of a millimetre to that of two millimetres. For the larger work of clocks ten cones will form a complete assortment, realising all the conditions enumerated, and comprising all the sizes of teeth from the pitch of one millimetre and a half to the pitch of four millimetres. But this is an exceptional number. An assortment of five cones plainly suffices for all usual work. Besides this double assortment, satisfying more than abundantly all the requirements of practical horology; cones of special size and teeth can be made as desired. But the exceptional merit of this new tool is, that under all imaginable hypotheses, the number of pieces comprising an assortment is exceedingly limited, and consequently inexpensive.

If we consider that, in order to possess a rounding-up tool approximately complete, it is necessary to spend at least £6. to £8, and for an assortment of Ingold fraises from £12 to £16, and that by using the rounding-up cones, by which the same result can be obtained, a sum of about £2 is sufficient, it cannot be denied that progress has been made, and that the introduction of this tool is a great advantage.

(*To be continued.*)

HALL-MARKING AGITATION IN DUBLIN.

THE Dublin correspondent of the *Times* writes under date August 23:—"A deputation of working gold and silver smiths of Dublin waited yesterday upon the Goldsmiths' Corporation at the Custom House, for the purpose of representing the alleged illegality of the practice of putting the hall-mark on articles of English and foreign manufacture. Mr. Lowen, the secretary, observed that the working gold and silver smiths desired to point out the injury which the practice complained of was calculated to do to their trade, and asked that if it were legal the Corporation should assist them in endeavouring to have the Hall-Mark Bill which was brought in last Session extended to Ireland. Mr. Johnson, the Master of the Guild, stated that the Corporation had obtained counsel's opinion, which was adverse to that of the deputation upon the question of legality. Mr. Bouchier Eaton, to whom the Goldsmiths' Company had referred the matter, said that he advised them to obtain the opinion of counsel, as the Acts of Parliament bearing on the question were very numerous and extended back nearly 100 years. Mr. Fitzgerald, whom they had consulted, had given it as his opinion that notwithstanding the words "manufactured by them," in the 17th and 18th Vic., cap. 66, sec 2, dealers in Dublin could have articles of gold and silver which they purchased in England legally assayed and marked in Dublin, the object of the assay being to certify as to the quality of the material and not the place of manufacture. Counsel's opinion was strongly confirmed by the interpretation put upon the law in England by Mr. Walter Prideaux, clerk of the Goldsmiths' Company in London. Mr. Eaton added that since he had come into the room he had received a communication from the Commissioner of Inland Revenue to the effect that they would adopt a course which would have the effect of preventing English manufactured goods being assayed in Ireland. The Goldsmith's Company were desirous of protecting their interests as far as they could. He did not think that any member of the Goldsmiths' Corporation of Ireland had goods manufactured in England and brought here to be assayed. Mr. West was not a member of the Corporation. The Master remarked that persons buying goods looked upon the hall-mark as an indication of the country from which they came. Mr. Martin said if the practice were general it would sweep away the trade altogether. Mr. Wortham said that the instance referred to (the testimonial to the Duke of Connaught) was the first which had occurred. Mr. Wallace stated that there had been two instances, but what happened in the Duke of Connaught's case had drawn public attention to the subject. After some conversation, in which the practice was strongly condemned as deceptive, and a change in the law advocated, Mr. Lowen said it was intended to hold a meeting and appeal to the public not to countenance the practice. The Corporation were then thanked for their reception of the deputation, and satisfaction was expressed at the communication which had been received from the Inland Revenue."

GREENWICH TIME BALL.

THE Astronomer-Royal, in his last report to the Board of Visitors (June 7, 1879), notices in regard to the Greenwich time-ball that there has been only one failure from accident in the automatic drop; on six days the ball was not raised on account of high wind; and on one day the mast was so thickly coated with ice that the ball could not be moved. The Deal ball was not dropped at one o'clock on seven days, through failure in the telegraphic connection; on two days the ball was accidently dropped about two seconds too soon by telegraph signals; on seventeen days the current was weak, and the trigger was released by the attendant, without appreciable loss of accuracy; on the nine days of failure of the ball-drop at one o'clock, a black flag was hoisted, and the ball was dropped again at two o'clock. The Westminster clock has not been quite so well regulated as usual. During the period to which this report refers, its error exceeded one second in seventy-seven days; on fifteen of these it was between two seconds and three seconds, on four between three seconds and four seconds, and on one day it exceeded four seconds.

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* Les Cones Arrondisseurs.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. V.

(*Continued from page* 3, Vol. 5.)

PRACTICE will soon teach how to handle the scratch-brush to advantage. Hand scratch-brushing is, however, long and tedious, besides the irregularity of the arm leaves often traces on fine objects, which are injurious to their appearance. For the brushing of such articles as table-ware, circular wire brushes are used by silversmiths, fixed in the spindle of a lathe, consequently, all the wires are equally impelled, and in the same direction.

Lathe for Scratch-brushing.—An ordinary lathe is used for scratch-brushing, upon the spindle of which is fixed a circular brush of brass wires mounted on wood or metal—the wires being from two to three inches long. The brush, set in motion by foot or steam power, turns towards the operator, and the articles are held to the lower part of the brush. A wooden frame covers the wire brush; it is open in front, the top supports a small reservoir, from which a jet of water runs upon the brush. A board receives the water projected by the rapid motion, and lets it fall into a zinc pan resting in the bottom of the box; through a hole in one of the corners of the pan the water is carried away by means of a rubber tube.

The brass wire used in the manufacture of scratch-brushes varies considerably in thickness according to the work it is intended to perform. Thick wires are employed for bronzes, thinner ones for lighter articles, and very fine ones for very delicate objects, such as wheels and bridges of watches; but we shall speak of these when we come to the gilding of watch-movements. When a hand scratch-brush becomes too short, the twisted ends are cut with a cold chisel, and a fresh portion of wire is uncovered by removing part of the string; this may be done again and again till hardly anything but the soldered end remains. To remove the twisted wire ends, rest the scratch-brush upon a lead block, and cut them with a sharp cold chisel, with one stroke of the hammer. Scratch-brushes should be carefully preserved, the wires must be kept stiff and straight, and when they begin to curl they are now and then beaten with a mallet of boxwood, upon a small block held between the knees, to present a dead stroke. Scratch-brushes if kept too long in water become hard; when greasy, they are cleaned in caustic potash, and oxide is removed by the compound acids. This last operation, and also dipping in aquafortis, are sometimes employed to reduce the size of the wires, and to render them smoother. The circular brush is occasionally reversed, in order to change the direction of the wires.

In some workshops an arrangement has been tried which keeps the scratch-brush as well as the object completely and constantly immersed in water; but owing to the increased turning power which the resistance of the water necessitates, this method has not found permanent application. As far as cleanliness is concerned, it would certainly be preferable, as the brush is not exposed to the oxydizing effects of the acid-vapours of the workshop. Scratch-brushing is a very important operation, especially as a great number of articles are sent into the market without undergoing any further manipulation. Beginners should always acquire considerable practice with this class of goods before touching expensive work.

Giving a Bright Lustre to Small Articles.—Very small articles, which cannot be scratch-brushed, receive a bright lustre by mutual friction. The operation is generally performed by hand. The articles to be brightened are introduced into a linen bag from three to four feet in length together with boxwood sawdust, bran, or sand; the ends of the bag are gathered into the hands with the thumbs inwards, and a to and fro movement is then given to it. The operation will be found less fatiguing if performed by two workmen, or if one end of the bag is attached to a peg in the wall about four feet from the floor.

Whatever method is employed this shaking is still very tiresome, and manufacturers of such small articles have, therefore, introduced mechanical means for the performance of this operation. These appliances vary with the objects they are designed to manipulate; but ingenious as some of them are, we abstain from giving here detailed descriptions, as they do not come within the province of gold or silver-workers.

We now come to the cleansing processes for zinc, lead, tin, cast iron, wrought iron, and steel:—

Cleansing Zinc.—Next to copper and silver, zinc is the metal which comes most frequently under treatment for plating. This metal, declared useless to manufacturers by the earlier chemists, owing to its brittleness, has of late years undergone such important improvements in its preparation, that it now enjoys a most varied and extensive application in the industrial arts. The colour of zinc being unattractive itself, is substituted by an artificial coating, which gives it the luxurious appearance of the precious metals. Articles of zinc are generally covered with a layer of gold or silver, but oftener still with only a powder of copper or brass, which, after certain chemical manipulations, to be described hereafter, give the articles every possible shade of bronze.

Before any of these operations are proceeded with, it is here again necessary to free the surfaces of the articles from every impurity. Zinc is cleansed by being passed through a boiling solution of caustic lye, without remaining too long in it, because it may be corroded and even dissolved; after rinsing, it is plunged for a few minutes into water containing one-tenth to one-twentieth of sulphuric acid, then rinsed in plenty of warm water, and, when necessary, brushed with a stiff brush and pumice-stone dust, or scratch-brushed. This last operation is especially useful when parts have been united with tin solder, which becomes black and dull by the alkaline and acid baths. Another method is to dip the articles rapidly into a cold mixture of—

Sulphuric acid	...	...	100 parts,
Nitric acid ...	...	...	100 ,,
Common salt	...	...	1 per cent.

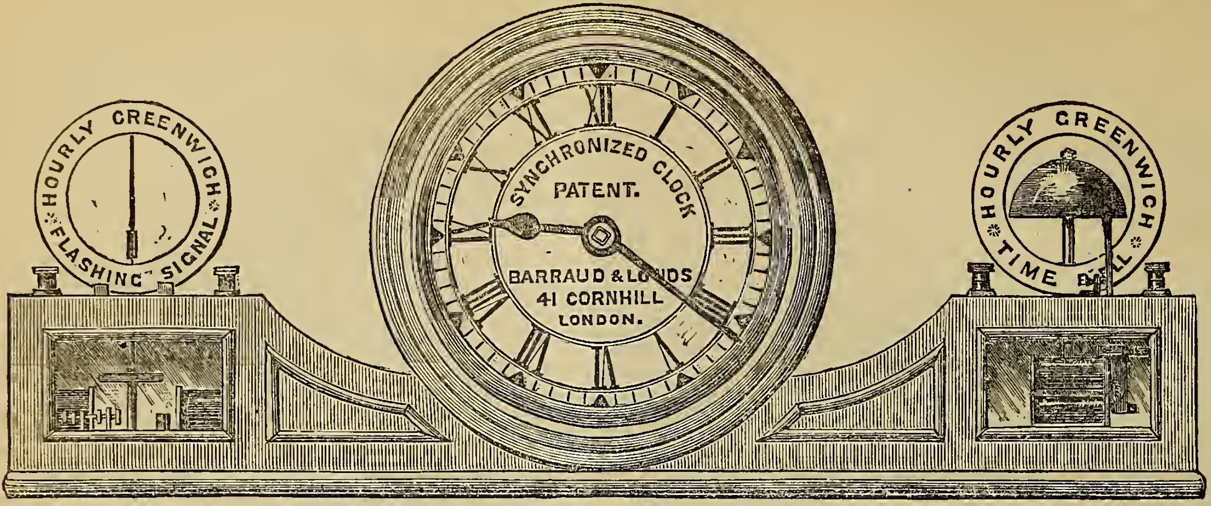
Quickly rinse in cold water perfectly free from copper salt, which would blacken the zinc. If instead of quickly cleansing the zinc, it is allowed to remain a little longer in the mixture, it acquires a dead lustre, which may be utilised for producing contrasts between the various parts of the same ornament. The dead lustre will become a bright one, if the object is quickly plunged in several times, and rinsed as often, in the same compound acids.

(*To be continued.*)

Prices Current for Gold and Silver.—Value given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver 4s. 6½d. to 4s. 9d. (variable according to quantity).

A NEW TIME SIGNAL.



SYNCHRONIZATION is becoming not merely a household word, but a great social benefit, for since we noticed the system patented and introduced by Messrs. Barraud and Lunds, the clocks connected to their system have increased on every hand, not only in private offices, but at various public positions where the full benefit of unvarying true time can be seen and appreciated.

Their system is now worked by twenty-five miles of wires, mostly over head, 165 clocks are now in connection with their standard, besides twenty-three time bells, and the number is being daily added to. Even hard times are unable to stay the success of a system which appeals so directly to the comfort and convenience of the public.

We have just seen a new application of the system, intended for the use of the trade, to enable them to get the full benefit of Greenwich time currents. Our engraving gives a very true idea of the appearance of the instrument, which has been designed and made by Messrs. Barraud and Lunds, for Messrs. Fowler and Son, 2, Kennington Park Road, and which combines, as will be seen, three distinct appliances, a clock synchronized by an hourly time current, and therefore shewing unvarying "Greenwich mean time," a bell striking an "Hourly Greenwich mean time signal," and an "Hourly Greenwich flashing signal," shewing to the eye that which the bell denotes to the ear, an hourly time signal, true to the fraction of a second; this flashing signal seems to be the only part of the apparatus requiring an explanation; it consists of a disc of thin metal, painted red, and standing normally with its edge to the front view, but which on arrival of the time current flashes round for three seconds, and then returns to its previous position. The origin of the introduction of the flashing signal by Messrs. Barraud and Lunds was for the use of the London Stock Exchange, where it was found impossible to hear the sound of a bell over the din and hubbub of the business below. The time ball has many objections, not the least its inefficiency in giving to the eye a sufficiently instantaneous signal, but the flashing disc was received with uproarious applause when first introduced on the Stock Exchange, and has remained the official standard for "time bargains" ever since. We have ourselves been within the mystic chamber, and can testify to its perfect working and excellent effect.

Where time signals are already received, no further expense has to be incurred, the clock and signal apparatus simply requiring to be coupled up in line. The expense of receiving the Postal Telegraph time signals has hitherto been felt to be heavy compared to the results obtained other than the immediate use to the trade, but these combined signals and clock place an attractive advertising power in their hands which they will, we expect, not be slow to avail themselves of. It is, however, especially in the Metropolitan district that the benefit will be most fully appreciated, as Messrs. Barraud and Lunds' time wires now cover nearly every portion of London, and they are prepared for the reasonable sum of £5 5s. per annum to deliver the needful hourly Greenwich time signals.

As regards the accuracy of their time signals, we may mention that by an ingenious arrangement their standard regulator for redistributing time is automatically corrected daily to the tenth of a second by time signals transmitted over their own private wire from Greenwich, by a plan which seems both simple and efficacious. On arrival of the 11 a.m. signal a comparison is made of the three standard clocks, besides the one used for transmitting the signals; by this means the occasional inaccuracy of the time received from Greenwich is detected, and its retransmission avoided. The true error of the transmitting standard having been thus determined, a peg is placed in a "commutator," having two holes marked "Fast" and "Slow," according as the clock requires to be accelerated or retarded, and the hand of a small automatic clock-shunt is set back the length of time required to produce the desired effect upon the clock pendulum to which a five inch magnet is screwed so as to vibrate freely over a resistance coil, through which the commutator causes an electric current positive or negative to flow. This clock-shunt is so arranged as to go twelve months with one winding up, allowing the standard clock an outside correction of one second a day, although in practice no such limit is actually required. The advantage of this system is two-fold, first of all, physical connection with the pendulum is avoided; and secondly, a few moments suffice to set both "commutator" and "shunt," after which no attention is needed, the operation being automatically closed as soon as the standard clock is to time. We have seen a letter from the telegraph superintendent of the Great Eastern Railway Company, in which he writes, "I can testify to the accuracy of the time-signals sent by you as I have also the Greenwich time current on another wire." The manager of the Indo-European Telegraph Company writes, "We use Greenwich time all along our line from London to Teheran in Persia, and telegraph it from this office, so that the Greenwich time correction signal, *as supplied by your firm*, is almost essential," and adds, "We could not now do without it." We have also seen letters from Messrs. Usher and Cole, St. John Street Road, Messrs. Thompson and Vine, Aldersgate Street, and many others, all testifying to the regularity and accuracy of the time signals sent out by Messrs. Barraud and Lunds, so that whether used in connection with the apparatus described, or simply as a time signal for trade use, they ought to be in constantly increasing demand. All details may be learned on application to Messrs. Barraud and Lunds, where the whole system may be seen in work.

JEWELLERY.

By George Wallis.

(*Continued from page* 8.)

It may be well to mention here a method of finishing real gold work, which has been adopted of late years with marked success. This is known as colouring, and without in any degree giving a fictitious appearance of value to the gold, it enhances the beauty of effect. It consists of a chemical process by which the atoms of the alloy are subtracted from the surface, leaving the pure gold alone visible. It is the very reverse of gilding, which is only a film mechanically or chemically applied. Of course the "colouring" wears or becomes deteriorated by exposure; but this is a very slow process; the body of gold, however, remains the same as it was, before the colouring process was applied as a finish to the newly made object. The colouring can always be repeated, if desirable; thus renovating the surface at will.

Having recurred to real gold work, it may be as well to state here that the economical arrangements of the workshops in which both gold and silver work is made, are of such a character as to save the metallic dust and filings, and scraps of metal, which of necessity fall about the benches and floors, and adhere to the aprons and hands of the workers. Wash-leather is largely used, especially in gold work, being soft and pliable, thus protecting one side of any object from being scratched or injured while the other is being wrought. These leathers become filled with the gold dust of the fine filings, and when so far worn as not to be available for their original purpose they are burnt in a crucible, and the gold which they have retained while in use, is found in the shape of a nodule of metal at the bottom, having been melted out of the worn-out wash-leather.

The sweepings of the workshops are carefully preserved, and when accumulated are treated after a similar fashion, not usually by the manufacturer, but by persons (generally gold refiners) whose business it is to make the most of these sweepings. It is calculated that about a pennyweight per ounce is the average loss in hand-made work, or even two pennyweights in very intricate and fine work, but in machine work it is much less.

So far, then, I have described the production of jewellery in its generic forms of "real" and "imitation" gold and silver work. There are, however, several other descriptions of so-called jewellery or trinkets, which may be mentioned. Notably the bog-oak ornaments produced in Ireland, in which gold and silver work is introduced, together with stones of various kinds, chiefly a species of crystal known as "Irish diamonds," as also native pearls. These bog-oak objects are all produced by hand, and often present features of considerable artistic beauty and taste.

Another kind has of late years been introduced at Birmingham, which was formerly only carried on at Paris. This consists of a basis of tortoise-shell, and also imitations of tortoise-shell produced by running gelatine mixed with metallic salts into moulds, the effect of the markings of tortoise-shell being produced by the staining with hydro-sulphate of ammonia. Horn is also used to imitate tortoise-shell, being stained and pressed into moulds while softened by heat.

The general form of the trinkets produced in tortoise-shell and its imitations are happily limited by the conditions of the material and mode of production, and thus extravagance in outline is restrained, and the study of geometric forms becomes almost a necessity of success. In addition, however, to the decorative effect produced by the general form of the object and the colour of the material, ornamental details are inlaid in gold, silver, and gilt metal. The effect produced is generally very pleasing and artistic, when too much elaboration is not attempted; thus pretty personal ornaments are brought within the reach of persons who cannot afford the cost of gold jewellery, and yet object to wear anything in imitation of a costly material, which may look pretentious and out of keeping with their ordinary style of dress.

Coral ornaments are extensively used in a great variety of forms, but the best work is of foreign manufacture. The peculiarities of the natural growth of coral have to be studied carefully by the designer and workman, so that advantgae may be taken of the formation in the production of special details adapted for setting in gold as personal ornaments. The material has ever been a favourite alike with rich and poor. The more splendid specimens in size and tint are used in the highest class of jewellery, combined with the richest and most elaborate gold setting, whilst the simple necklace of coral beads is a prize of which the peasant girl is as proud as the princess can be of the elaborate tiara. Yet both are derived from the same source, and both have that invaluable quality, which all should desire in decorative adjuncts, as in other things,—truth. There is only one other class of jewellery in trinkets which may be considered worth naming here, as also being *real* in itself and yet having its imitations. This is jet work. This beautiful material, so susceptible of artistic treatment in a variety of forms, is found at Whitby in Yorkshire, in connection with the lias rocks of the district. It appears to have been used for decorative purposes of one kind or other for a very long period. Being bright and lustrous, when cut into proper forms, polished, and properly set, it presents a very tasteful appearance, and is particularly well adapted to wear with mourning. A considerable trade is carried on in Whitby, but the mounting is chiefly executed at Birmingham and in Clerkenwell. Imitations of it are produced in glass to a very considerable extent, as also from a compound in which caoutchouc and sulphur enter very considerably, and which is known as vulcanite and ebonite. Wood powder blackened and moulded in a plastic state, and finally hardened, is also used in making imitation jet ornaments of a cheap character. The great objection to these cheap jet ornaments is, that they have to be readily and economically mounted in plates of metal, from which, however, they are very liable to separate. The French use shellac as a cement, but a separation is inevitable under the changes of temperature in wearing. The English system is more permanent, and in those objects to which it can be applied, the glass and metal are fused together by means of a foil and flux.

Certain statistics of the jewellery trade are well illustrated by Mr. J. S. Wright, of Birminghan, in a report on the jewellery and gilt toy trades of that town, prepared in 1865, on the occasion of the meeting of the British Association for the Advancement of Science, and subsequently published in a work on the Resources, Products, and Industrial History of Birmingham, and the Midland Hardware District. He states that in the gold chain trade "there are forty-seven master manufacturers, some employing two to three hundred hands, but the greater part not more than ten or twenty. Altogether fifteen or sixteen hundred persons are engaged in chain-making, about five hundred being young women, who earn good wages, and maintain a most respectable appearance."

(*To be continued.*)

THE REPORT OF THE GOLDSMITHS' COMPANY OF GLASGOW.*

THE fact that Scotland has unanimously pronounced in favour of complete freedom of trade in gold and silver plate and watches, is significant that the prevailing system will, ere long, be abolished. Unhappily, it may be presumed that England will delay legislation for some considerable time. The question not being one of much public interest, it may be difficult to stir Parliament to any immediate action. Of course, if the trade were to any great extent unanimous in the belief that increased business would result from the removal of fiscal and other hindrances, it would not be at all difficult to pass a Bill through the House of Commons. The arguments in favour of freedom are such as would commend themselves to a majority of members, and an unopposed motion would soon result in that freedom which, in the interests of art progress and technical education is so much to be desired. The reasons for the abolition of taxation are cogent:—(1) It is unjust. (2) It is impolitic. (3) It is subversive of the principles of modern fiscal legislation. (4) It is obstructive to art progress; and (5) It is an insurmountable obstacle to technical education in its application to silversmiths' work. These are serious reasons why taxation should be abolished with as little delay as is consistent with the state of the revenue. It must be confessed that the state of the revenue leaves but little hope that immediate legislation will follow the report of the Select Committee. However, delay will seriously affect the prosperity of the trade, inasmuch as the ultimate abolition of taxation is seen by shopkeepers to be a certainty, and, naturally enough, there is already perceptive an indisposition to order for stock under a feeling of doubt whether the Chancellor of the Exchequer will recognise the right of holders of duty-paid plate to compensation. It is a difficult question. Whether in 1758, when the duty, originating in 1719, was abolished, the trade had compensation, is not known, as the books are said all to have been destroyed. So no precedent can be quoted at the present time. All points, therefore, to the urgency of immediate action on the part of manufacturers to hasten legislation, as delay will only tend to increase depression. Again, manufacturers themselves will feel constrained to decrease their stocks, so workmen are likely to have "hard times" until something definite is done. It is one of those cases which demands immediate action. Manufacturers, with the report of the Select Committee before them, must rest assured that the agitation for the repeal of the duties upon gold and silver plate is not likely to be abandoned. Directly Parliament meets the agitation will be renewed, and in the recess it is likely that public attention will again and again be called to the urgent necessity of relieving this branch of industry from the pernicious effects of anachronistic laws. It is true that complete freedom of trade is scarcely to be expected from a Conservative Parliament, but we would remind our readers that Conservative Parliaments are not immortal, and that a Liberal Chancellor of the Exchequer may, ere long, reign in Downing Street, and that Mr. Goschen himself might be in office, when, without doubt, he might be expected to give effect to his opinions which are to be found recorded in the Blue Book. Not only will the duties be abolished, but, without any manner of doubt compulsory hall-marking will go too. If not abolished by means of an enactment providing for a voluntary system of hall-marking, under uniformity of practice, and under altogether altered conditions, namely, the abolition of the "town" and "date" marks—a measure which we are convinced would be of considerable benefit to the entire trade—it will, as the *Times* hinted, in a moderate but able article, simply "fall into disuse." The Government will have no interest in maintaining it; the Goldsmiths' Company will simply be set at defiance, and it is very questionable whether, if they proceeded to extremities, the law would be found to be on their side. Their rights are held under charters of most questionable construction, and legal opinions already differ as to the powers of City companies to maintain ancient customs which are held to have become obsolete under the present conditions of modern trade, and in the face of an increased and rapidly increasing population. Again, as we read the charters of the Goldsmiths' Company, they would not have "a leg to stand upon" in a court of law, after the abolition of the duties. At all events, the question will be tried, and even if the law were given in their favour, public attention would have been directed to the folly of the law, and the power of the press would be brought to bear in order to secure its abolition.

It is to be hoped, therefore, that the trade will, during the recess, become impressed with the conviction that the best course they can adopt is to prepare a Bill, drawn upon free trade lines, providing, as recommended by the Goldsmiths' Company of Glasgow, for the abolition of all the old laws governing the trades, and for a system of voluntary hall-marking which shall have for its object a simple guarantee of quality. It is gratifying to learn that the Birmingham jewellers are also beginning to recognise the vital importance of this question; the *Birmingham Daily Post*, in a recent issue, says: "if the recommendation of the Hall-marking Committee to abolish the silver duty altogether should be adopted, a great extension of trade in this branch may be looked for."

THE BIRMINGHAM JEWELLERY TRADE.

THE *Birmingham Daily Post* says:—"A considerable impulse has been given to the trade in lockets and hall-marked Alberts since the duty upon these goods was abolished, and if the recommendation of the Hall-Marking Committee to abolish the silver duty altogether should be adopted, a great extension of trade in this branch may be looked for. It is to be hoped that the mischievous proposal for abolishing the lower gold standards, which have worked so advantageously, both for the trade and the public, will not be allowed to pass into law. The danger is averted for this session, but manufacturing jewellers will have to be on the alert against the introduction of a measure of this character next year."

MOLECULAR OSCILLATIONS.

MONS. RAOUL PICTET, of Geneva, one of the two chemists who not long ago were so brilliantly successful in liquefying hydrogen, has recently been engaged in researches which deal with some of the most delicate problems in molecular physics. He has endeavoured to determine the length of the molecular oscillations of a body subjected to the action of heat. No explanation is given as to the method of calculation employed, but M. Pictet arrives at the remarkable result that the product of the length of molecular oscillation by the temperature of fusion is constant in all solid substances. He adds that the higher the temperature, the shorter are the oscillations. Here are some of the figures: Selenium, 3·7, lead, 3·3, zinc, 3·5, silver, 3·8, copper, 3·4, gold, 3·4, iron, 3·3, platinum, 3·6. These numbers are evidently near enough together to warrant the statement that the law of constancy is here verified with conditions of exactness comparable to those which Dulong and Petit declared satisfactory in their researches on specific heats.

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* See August number of this Journal.

CURIOSITIES OF CLOCKS AND WATCHES.

(*Continued from page* 158.)

IN 1753 was published a description of two methods by which the irregularities in the motion of a clock, arising from the influences of heat or cold on the rod of the pendulum, might be prevented, with some papers on the same subject previously read before the Royal Society, by John Ellicott, clockmaker and F.R.S. In the Philosophical Transactions of 1761 are observations for proving the going of Mr. Ellicott's clock at "St. Helena," by Charles Mason. In the same work, in 1762, appear further observations "Concerning the going of Mr. Ellicott's clock at St. Helena," by James Short, F.R.S. In the same work and year were published "Observations on a clock of Mr. John Shelton, made at St. Helena," by Nevil Maskelyne, D.D., F.R.S., an astronomer and mathematician. About this time were carried on smart contests on the subject of the improvements made in the pendulum, and several claims to new inventions therein were set up by rival mechanics. In 1772 was published the mezzotinto three-quarter length portrait, engraved by Dunkarton, after Dance, of John Ellicott, who died in that year, aged sixty-seven. He is represented sitting. At Greenwich Observatory was an astronomical clock made by Shelton, before named.

The Horse Guards clock was originally made by Thwaites, of Clerkenwell, in 1756. It is a large thirty-hour clock, striking the quarters upon two bells, and showing the time upon two white dials with black figures, seven feet five inches in diameter, one facing St. James's Park, and the other Whitehall. The frame is of wrought iron, the wheels are of the best yellow brass, and the escape and centre wheel, arbors and pinions are of case-hardened and tempered steel. The going part discharges the hours as well as the quarters. Originally the clock had a common recoil escapement, and the pallets became much worn. The pendulum was eight feet two inches long, and to reduce the arc of vibration it was furnished with fans. In 1816 the going part, including the dial, works, and hands, and the connecting rod-work, was made by B. L. Vulliamy, the Queen's clockmaker. The new going train consists of only three wheels, namely, an escape, which makes one revolution in four minutes; a centre wheel, one revolution in an hour; and a great wheel and two pinions, each of twenty-two teeth. The brass barrels and caps are new, and a ratchet attached to the great wheel keeps the clock going while being wound. The pivots work in gun metal holes, in bosses, which are held by screws, not riveted. The front pivot of the escape wheel carries a seconds hand, which, as the pendulum vibrates two seconds, shows the seconds by the hand advancing two seconds each vibration. The pendulum has a teak-wood rod, and a cast-iron bob, weighing one hundred and ninety pounds. It is terminated by a gun-metal screw and nut, cut into a strong thread, by which the clock is regulated. The pendulum is so hung as to be independent of the frame of the clock, which can be taken to pieces and cleaned without disturbing it. The escapement is the pin-wheel. "In this clock," says Vulliamy, "are applied, it is believed for the first time, the following improvements:—a dead pin-wheel escapement, a two seconds pendulum, a ratchet, to keep the clock going while being wound, and a degree plate, to indicate very correctly the arc of the vibration of the pendulum."

The "Annual Register" for 1760 tells us that at a quarterly meeting of the governors of Dublin workhouse, held on October 6th, 1760, under the presidency of the Earl of Lanesborough, it was resolved unanimously, "That the thanks of this board be presented to the Right Hon. Lady Arabella Denny, for the continuance of her kind and most useful attention to the foundling children, particularly for a clock lately put up in the nursery, at her ladyship's expense, with the following inscription, viz., 'For the benefit of infants protected by this hospital, Lady Arabella Denny presents this clock, to mark, that as children reared by the spoon must have but a small quantity of food at a time, it must be offered frequently; for which purpose, this clock strikes every twenty minutes, at which notice all the infants that are not asleep must be discreetly fed.'"

The subjoined description of a curious vocal clock is given in the journal of the Rev. J. Wesley:—"On Monday, April 27, 1762, being at Lurgan, in Ireland, I embraced the opportunity which I had long desired, of talking to Mr. Miller, the contriver of that statue which was in Lurgan when I was there before. It was the figure of an old man standing in a case, with a curtain drawn before him, over against a clock, which stood on the opposite side of the room. Every time the clock struck, he opened the door with one hand, drew back the curtain with the other, turned his head as if looking round on the company, and then said, with a clear, loud, articulate voice, 'past one,' or two, or three, and so on. But so many came to see this (the like of which all allowed was not to be seen in Europe), that Mr. Miller was in danger of being ruined, not having time to attend to his own business. So as none offered to purchase it or reward him for his pains, he took the whole machine to pieces."

About the middle of the eighteenth century, Colonel Magniac, a famous clockmaker, lived in an old mansion in St. John's Square, Clerkenwell, and had his workshops there. This manufacturer's automaton clocks caused much interest at the Court of China and elsewhere, and perhaps did much to render Clerkenwell noted as the clockmaking parish. Two of the most remarkable clocks manufactured by him for the Emperor were rare specimens of mechanical skill; in addition to regiments of soldiers, musical performers, parading beasts and birds, all displaying appropriate action, combined to show what varied and graceful motions could be produced by wheels, pinions, and levers, and while pleasing the eye also charmed the ear by the bell music, tunes and chimes. Early in the present century the above-mentioned mansion was pulled down, and Messrs. J. Smith and Son purchased the freehold and built their extensive clock manufactory upon it.

In the last century, Henry Bridges, an architect, of Waltham Abbey, constructed an elaborate mechanism called the Microcosm, or Little World; which, after his death, came into the possession of one Edward Davis, who, some time between 1764 and 1789, publicly exhibited it, and published a pamphlet describing it, containing an engraving of the machine. It was built in the form of a Roman temple, being ten feet high, and six feet broad at the base; and consisted of five principal parts. It contained a variety of moving, life-like figures of men, women, and animals. At the top were three scenes, which changed alternately. The first represented the Muses on Parnassus; the second, a forest with Orpheus and wild beasts; the third a sylvan grove with birds flying and singing.

In the centre of the structure stood a clock, which was divided into two astronomical systems, the uppermost being the Ptolemaic, and the lower the Copernican. In the former, the earth represented the centre of motion, with an hour circle round it, and the sun and moon revolved every twenty-four hours. It showed the rising, southing and setting of the sun, which always pointed out the hour of the day, and rose and set at the same time as it really did. There were two blue circular plates, called horizons, one on the left and the other on the right, which rose and fell according to the lengthening or shortening of the days, in order to regulate the sun's rising and setting; so that as the sun went round in twenty-four hours, being within the hour circle, it passed by every hour on the plate, and pointed out the time of the day.

(*To be continued.*)

BRONZES.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 7.)

THE early tombs of Vulci Perugia and Cervetri have afforded notable examples of such *sphyrelata* in hammered work, particularly the singular archaic female bust, with long ringlets, and a base ornamented with figures, in *rilievo*, of sphinxes, chariots, &c., which is now preserved in the British Museum. On this invaluable monument of early toreutic art (which was discovered in the grotta d'Iside, at Vulci, together with Egyptian objects of pottery, &c.) no soldering is to be seen: the plates are held by pins upon the wooden core; the corkscrew ringlets are formed of coils of the thin metal cut previously into ribbons, and attached by a nail above; the timidly defined features and members are produced by hammering the metal from within, as are the bas-reliefs of curious animals, perhaps beaten into a corresponding intaglio, previously incised in stone or wood; and the junction of the various plates is cunningly concealed by overlying ornament.

Here we should pause to consider the circumstances under which these works were produced, and the influences which led to their adoption and development. First, we must recollect that the metals were difficult of production, and valuable accordingly; economy in its use was therefore necessary, and it was important for the artist to produce the largest possible effect with the smallest quantity of material. We have said that the art of fashioning metal by means of beating with the hammer was probably of earlier date than that of casting, and this would seem to have been the case with the ancient inhabitants of Ireland, India, and elsewhere, who first began the use of metal weapons formed of beaten copper. For the formation of vessels, in which lightness was an almost indispensable quality, such a process would naturally be adapted; and thence, by successive stages of improvement, the art of the coppersmith rose on the one hand to the dignity of sculpture, and on the other to the production of vessels and articles, more or less ornamented, for domestic, sacerdotal, aud funeral uses. This course of improvement in one direction was natural and sequent, maintaining its independence of the sister art, that of the founder, which in a parallel course struggled through the greater difficulties retarding its earlier life, until an equal perfection was attained. Schooled by practice, and working hand in hand, they united to produce during the palmy days of Egypt, Greece, Etruria, and Rome, those unsurpassed works of bronze in every form, from the most delicately-fashioned personal ornament to the heroic statue, of which we have so few memorials still left to us.

By these, however, we are enabled to trace the progress of the art: the hammered plates, nailed or rivetted together; their mode of attachment developed into a constructive ornamental *motif*—the native root from which all healthy ornamentation should take its rise; then united by soldering and accentuated by mouldings, covering the joint and declaring the stages of construction; again, later, by the union of the kindred arts, the hammer-formed body of the vase, with the handles and more solid ornaments cast and soldered or rivetted on. Both branches of the art must also have combinded to fit the warrior chief for the battle-field: his spear and arrowheads and the blade of his sword were moulded from the furnace; while his shield, his helm, and armour were more frequently beaten into form, and finished by the chasing-tool and punch.

And still these parallel methods of fashioning copper and its various alloys to the requirements of the highest and most ordinary of human purposes, have continued to work together in steady development from those dawning days of civilisation and infantile but earnest striving with the difficulties of metal work down to this our age of scientific and manufacturing power and industry. Especially we must not lose sight of the dexterous handiwork requisite to produce the results bequeathed to us from those early times. The skilful manipulation necessary to fashion from the lump such even and thin plates of bronze by the action of the hand hammer only, would put to the blush many a modern workman proud of the facility with which he can apply the improved mechanism of his tools.

But in the one case, as in all pure handicraft, the mind is excited and led on in striving to attain a dexterity which the hand and head and not the tool can furnish, and the hammer, like a painter's pencil, becomes a means of communicating mind to matter, recording the painstaking assiduity and artistic skill and sentiment of him who wielded it. The perfection of modern machinery acts in the contrary direction. The almost self-acting tool conveys its material and mechanical quality to the human machine who starts it into motion, and assists its labour merely by the tightening of a screw or the withdrawal of a pin; the result is the production of the machine rather than of the man who tends it. Art and handicraft are man and wife; mechanism and manufacture (so miscalled) are also wedded, and a fertile pair; but they are of a younger and less noble branch of a grand old family. Nevertheless they are suitably adapted to our age; but it behoves us, in their encouragement, never to forget the more inspired works and higher artistic claims of the older family, nor to check our admiration and encouragement of those among its members who will, for the love of what they do, individually devote themselves to any one branch of artistic handicraft.

We will now attempt, but still only in a superficial manner, to follow up the investigation of the use of bronze by the sculptors of Etruria, of Greece, and of Rome, during the periods of their several histories, before entering upon the consideration of its employment in mediæval and more recent times. The antiquity of civilisation in Egypt is one of those archæological problems which will long remain to be solved, although light is steadily gaining upon the subject, and the well-directed researches now being made will gradually dissipate much of the darkness in which its earlier history is yet obscured. So also with Assyria, for who can say now to what remote period a high degree of development in the industrial arts may not have existed among the inhabitants of the cities and towns watered by the Euphrates, a development which, judging from what we already know of its remains, appears to reduce much of Hebrew chronicle to a comparatively recent time. As far back as we can trace, the use of bronze seems to have been abundant, and its fabrication both by casting and beating perfectly mastered. We learn by the inscription of Una, of the period of the sixth dynasty in Egypt, how he brought "the sarcophagus with its cover and pyramidim," and "a granite doorway, with sill, granite doors, and lintels," to the Shanefer pyramid; from which we may infer that the bronze tools requisite for the working of these objects were in familiar use. Some centuries afterwards we find in the annals of Thothmes III. (eighteenth dynasty, about 1800—2000 B.C.) a record of vases of bronze, as well as works in gold, silver, and iron, and tent-poles ornamented with bronze. Bricks (probably ingots) of copper from the "wretched Kush;" brass armour and other metal work from them and the other peoples whom he had conquered. Again, in the narrative of the battle of Megiddo, gained by Thothmes III. over the confederate kings of Palestine, mention is made of the chariots plated with silver and gold captured from the enemy, suits of brass armour, some inlaid with gold, one from the chief of Maketa; vessels of brass (or bronze); arms and weapons of the same metal from various tribes.

(*To be continued.*)

HINTS TO REPAIRERS.

(*Continued from page* 20.)

We have now arrived at the centre wheel, and will have a few remarks to make on that and its pinion, pivot-holes, etc. No doubt there are some, if not many, who are in their "teens" so far as watchwork is concerned, but may be old in years, that will wonder what anyone can find to talk or write about concerning the centre wheel and pinion, as they evidently never do anything to them; and as for the centre holes, why, a few taps with the hammer on a round punch will close up the holes, and if it does throw it out of upright and make it rub against the lower side of the barrel or fuzee it can be filed off, or, if it rubs the lower plate, that can be remedied by turning out the plate on the universal lathe, or, in the absence of that indispensable tool, it can be scraped with a graver, or the lower side of the wheel filed sufficient to allow it to "go," and as for the lower hole being made very *thin* by this punching process, that is nothing.

If such people did not exist, certainly so many watches would not tell the same tale, and watchmakers would not be accused of "stealing out the jewels" quite so often; for if a man's watch performs well after being repaired, its owner very naturally concludes that his watchmaker is one of the honest good workmen.

The centre pivots, especially the lower ones, are usually the first that begin to show any signs of wear. The pressure on the lower pivot is great, and its hole is usually made too thin, consequently, the pressure is exerted on a very small surface, the oil is all forced out, and small particles of dust get forced into the brass, if a plain watch, which acts as a "grinder" on the pivot. The pivot soon gets dry and rusty, small particles of steel become embedded in the hole, and last, but not least, the rust also, which is the oxide of iron, the same thing as crocus or polishing stuff, only made somewhat differently. What watchmaker would think of leaving a particle of this on a pivot when he put the watch together; and yet some will apply a little oil to a rusty pivot and say that there is nothing the matter with the watch. New oil will not cure such a complaint, but the following process will.

Shellac the pinion up in the lathe, true it up by the old pivot where it is not worn, turn out every sign of a groove, and get the pivot straight and true, then grind and polish same as for fuzee pivots; then broach out the centre hole, file up a piece of hard brass wire to fit it, then rivet it in; the holes should be slightly chamfered on both sides, and in rivetting in the bush do not hammer it so hard as to stretch the plate; pin or screw the plates together, put up in the universal lathe and centre from the upper hole. By this means you will get the wheel in upright, which is a very important thing. Centre and drill a hole a very little smaller than is required, then true out the hole with a cutter, for the drill will not make a round hole, and may get it a little out of centre; take the plates down after having finished the lower end of the hole, broach it to fit, and polish with the round broach. The upper pivot and its hole can be treated in the same way, if necessary.

It sometimes happens, by turning out the worn portion of the lower pivot, that all the shoulder for the cannon pinion is turned off, and the cannon pinion will go down to the shoulder. It would certainly not do to leave it in this condition, for the cannon pinion would then bind against the plate; but you can drill a hole in a piece of steel wire and cut off a piece just a little longer than the old pivot, and fit it on tight, being careful to have it come tight up against the shoulder, then temper it, and, if necessary, use a very small piece of soft solder to hold it fast. If acid is used to make the solder hold, wash the pinion in clean water, then in alcohol to get rid of every trace of the acid, otherwise the watch may stop in a few days, and which, on inspection, will reveal a rusty pivot. Having got the collar fastened on, turn up a pivot to the proper size and polish it as directed for the fuzee pivots. If the job is neatly done, no one would ever discover it, and it will save putting in a new pinion.

If the upper pivot is broken, a new one must be put in. Hold the pinion in a pair of plyers and direct a sharp flame from the alcohol lamp with the blow-pipe against the extreme end of the staff of the pinion and bring it down to a light blue, being careful not to discolour the leaves of the pinion. If you do get them to a blue, however, you may remove the colour by immersing the pinion in diluted sulphuric acid, washing immediately in clean water, then in alcohol. Cement the pinion up in the lathe and true it up by the outside of the staff part of the pinion, then with a hard drill, a trifle larger than the pivot to be made, drill a hole in the end, revolve the lathe very slow, working the drill back and forth all the time, which will prevent its becoming "choked," and have a less tendency to polish the bottom of the hole. In the latter case, use a little sulphuric acid in the hole to roughen it so that the drill will bite again. Drill the hole once and a half as deep as the pivot is to be in length, then get a paper of the best needles, select one, and draw it down to a deep blue, file it to fit the hole, and cut off enough to make the pivot, allowing for depth of hole, drive it in tight and then turn down to the proper size, and grind and polish as directed for fuzee pivots.

In case one of the leaves of the pinion is broken, or if the pinion is badly worn, or too large or too small, a new one must be put in. As we will devote one article to pinions, we will defer giving directions for putting in a new one until we come to that subject, and will then give directions for putting in the centre, third, fourth and scape pinions. If the cannon pinion is too loose, never resort to the very common but pernicious practice of putting in a hair or piece of tissue paper, as this method will throw the cannon pinion to one side, and have a tendency to make the hands lock. The best plan is to place that portion of the centre pinion staff that goes in the cannon pinion between two files, rolling it carefully back and forth a few times, using considerable pressure, which will raise a very even file-like surface on the staff, increasing its diameter by means of the roughness sufficient to make the cannon pinion hold tight. If this process fails to tighten it sufficiently, it will be best to put on a new cannon pinion.

The centre wheel will frequently be found to have several teeth soldered in, or the teeth may be worn so as to cause the watch to stop, in which case a new wheel must be put in. Select one of the proper size and number of teeth, and stone it up flat and of the proper thickness. It may be necessary to file it a little on one or both sides before stoning, after which polish it on boxwood with Vienna lime and alcohol, or gild it as may be required, using a scratch-brush to remove the burr from the teeth. Remove the old wheel and put the pinion up in the lathe, and turn off the points of the leaves that held the old wheel on; take down the pinion and put up the wheel, using a hollow chuck; true up the wheel by the outside, as it frequently happens that the hole is not in the centre. With a cutter turn out the hole to fit the pinion, take it down, and after having cleaned it and the pinion of shellac by boiling in alcohol, rivet it on. For this purpose, every watchmaker should have a good staking tool, of which there are several in the market; but, not having used them all, we cannot speak of their respective merits, and in these articles we shall speak of no tool, only from actual experience. Some years ago we made a staking tool, which anyone can make, and a description of which we shall give in our next.

(*To be continued.*)

PRECIOUS CORAL.

The precious coral of commerce is, after pearls, the handsomest and most valuable production obtained from the ocean depths. Corals are ranged by naturalists in the animal kingdom, at the head of zoophytes or animal plants. They are of two kinds—those deposited within the tissues of the animal (*sclerodermic*) and those secreted by the outer surface at the foot of the polyp (*sclerobasic*). Among the sclerodermic species we find such familiar forms as the "star coral" (*Astræa*); "brain coral," or "brain-stone" (*Meandrina*); the "mushroom coral" (*Ctenactis*), differing from other kinds in being the secretion of a single gigantic polyp, and in not being fixed; the "madrepore" (*Madrepora*), a neatly branched kind, with pointed extremities, each ending in a small cell; "sponge coral" (*Porites*), also branching, but with blunt ends and smooth surface; "organ-pipe coral" (*Tubipora*), consisting of smooth, red tubes, lying nearly parallel, and connected by cross-plates; and many others. Most of these, with other so-called corals, are to be seen in the shop of nearly every dealer in shells and natural history specimens, and are used for ornamenting chimney-pieces, drawing-room tables, cabinets, and for museum purposes. The organ-pipe coral being much cheaper in price than the more costly article, presently to be spoken of, is frequently used as its representative in cabinets of economic products. The majority of the calcareous frameworks that we designate a "coral" are white, or nearly so. At a recent meeting of the New York Academy of Sciences, Dr. Newberry exhibited a beautiful specimen of a sclerodermic coral—a species of *Oculina*—which had a pale green tint, a colour hitherto unknown in connection with the calcareous skeleton, although common with the animals themselves.

The coral which is alone used for articles of personal adornment and works of art is known as "precious coral" (*Corallium rubrum*), and is an example of the sclerobasic division. A sclerobasic coral is a true exoskeleton, and is distinguished by being smooth and solid. The polyps, having light fringed tentacles, are situated on the outside of this as a common axis, and are connected together by the fleshy *cænosarc* covering the coral. The precious coral is mostly obtained in the Mediterranean, and occurs of different shades of colour, the Barbary coast furnishing the dark red, Sardinia the yellow or salmon colour, and the coast of Italy the rose-pink. In Europe the latter colour is the most valued, while in the East the dark red is preferred. Occasionally the red coral is found white, or without any colouring matter. At the Naples Maritime International Exhibition a magnificent branch of black coral from Trapani was shown, which formed a finish to the trophy of aboriginal arms and weapons exhibited from the Pacific. At Yeddo there is a black coral fishery which extends fifty miles north and south. From taking a fine polish the black is fashioned into beads and mouth-pieces for cigars. The dull white is not quite so hard, and as it does not polish well is sold cheaper.

Coral presents to the fisherman the appearance of a branching shrub, of a red or rose colour, compact and solid. The material has the hardness and brilliancy of agate; it polishes like gems and shines like garnet, with the tints of the ruby. The large branches are used for carving, and, as the material is durable and is well suited to give definite outlines to the sculptors' work, great labour and ingenuity are frequently expended on objects of art wrought in this material. The Chinese, Hindoos, and Cingalese have all tried their skill in carving coral, but the finest and most artistic work emanates from the Italian workshops of Naples, Genoa and Leghorn. Much of the manufacturing process, grinding, drilling, and polishing, is carried on by women. The working of beads is principally executed by the females of the Val di Bisagno, in Italy. All the operatives employed in cutting belong to about 100 families in the commune of Assio; those in piercing and rounding to about 60 families living in other parts of the valley. Every village works exclusively at beads of a fixed size.

In Genoa each manufacturer employs from ten to twenty or more women, who submit the coral to a preparatory process before it is given to the workers of Bisagno. Thirty or forty men and women are employed in their own homes in cutting coral into facets. There are also about thirty engravers of cameos and coral. In all, from 5,000 to 6,000 persons gain their livelihood in the province of Genoa, either by fishing for, working in, or selling coral, and this craft produces a revenue of $400,000 per annum. Exports of coral are made from Genoa to Austria, Hungary, Poland, England, America, Aleppo, Madras, and Calcutta. Large, perfect, well shaped beads are by far the most valuable form of coral, and these have greatly increased in estimation of late years. Many of the finest are sent to China, where they are in demand for the Mandarin's red button of rank worn in the cap. Some of the natives of India have a preference for what may be called worm-eaten beads, and tons of these, which would not find a sale in Europe, go to the East, where they are esteemed from a superstitious belief that gods dwell in the little recesses or cavities of this coral.

Connoisseurs know that of late years coral has risen considerably in the estimation of the fair sex. A somewhat arbitrary standard of beauty has, however, been established in regard to the colour. Coral, to be rare and valuable, must now be of a delicate pinkish, flesh-like hue, uniform in tint throughout, and in large pieces. The principal commercial varieties distinguished are red, subdivided into deep crimson red, pale red, and vermilion (the latter rare), black, clear white, and dull white (the latter common). The delicate rose or flesh-coloured, which is most prized, is sold at very high prices, as it is entirely a fancy article. In some countries red coral is classified by dealers into five grades; 1, froth of blood; 2, flower of blood; 3, 4, 5, blood of first, second and third qualities. Dealers and workers in the material recognise rough tips, and polished tips, fragments, roots of branches suitable for making earrings, and coral tulips for shaping into ornaments. Coral branches assume the espalier shape and other forms.

Coral is valued, in addition to its colour, according to its bulk, soundness, and freedom from flaws. Certain rare kinds, of pale tints, are worth twenty times their weight in pure gold. The fact, too, that a large part of the material is wasted in the process of manufacture adds greatly to its cost. The value of ordinary red coral is apt to fluctuate greatly at the seat of the fisheries. In 1867 it was worth only $4 per pound, but it occasionally brings $10 per pound. This variation arises not only from differences in quality of the gathering, but also from special circumstances connected with the markets of distant countries, the sale of the article being much smaller in Europe than elsewhere.

Coral fishing is prosecuted at various points in the Mediterranean. The Spanish fishermen collect off the Cape Verde Islands, the product being about 24,760 lbs., of the value of $100,000 annually. Large quantities are also obtained on the south coast of Corsica by Italians. Coral is also gathered in more or less abundance along the coast of Tunis, Algiers, Morocco and Barbary. The number of boats engaged in this fishery on the Algerian coast has averaged of late years about 300, more than two-thirds of which are Italian. The product is said to amount to about 75,000 lbs. A coral bank of great richness is said to have been discovered on the coast of Japan, but no fishery of any importance has yet been begun there. The largest fisheries are in the vicinity of Sardinia, the exports from these amounting to $300,000 in value. The coral is chiefly found in the shallow waters near Carloforte, Alghero, and the

Island of Maddalena. At Alghero, about 190 vessels, manned by 1,930 sailors, are employed in the fishery from March to October. Hitherto the fishing operations have been conducted on the primitive method of the drag-net, or rough dredge, formed of a cross of wood with a quantity of hemp attached to tear up the coral. The diving-bell has been made use of, but it does not succeed. A few French fishermen use diving apparatus. Torre del Greco, near Naples, is the principal residence of the coral fishers, and the place from which most of the boats are fitted out for the business. The industry is annually acquiring larger importance, and the fishing is being prosecuted with increased energy.

As to other corals than the precious kind, madrepores and other showy species are sometimes used for ornamental purposes. The horny axis of black flexible coral *(Plesaura crassa)* is used for canes and whips in the Bermudas, and the axis of fan-coral *(Rhipidogorgia)* for skimmers in the same islands. Coral is used for building purposes in the Pacific Islands, Mauritius, Seychelles and other places. Coral rock of recent formation *(Coquina)* is employed in Florida in the manufacture of ornamental vases and earrings.—*Scientific American.*

TRADE RECIPES, &c.

(*Continued from page* 21.)

To Blue Small Steel Articles.—Make a box of sheet iron, fill it with sand, and subject it to a great heat. The articles to be blued must be finished and well-polished. Immerse the articles in the sand, keeping watch of them until they are of the right colour, when they should be taken out, and immersed in oil.

To Give Cast-Iron the Appearance of Bronze.—The article to be treated is first cleaned with great care, and then coated with a uniform film of some vegetable oil; this done, it is exposed in a furnace to the action of a high temperature, which, however, must not be strong enough to carbonize the oil. In this way the cast-iron absorbs oxygen at the moment the oil is decomposed, and there is formed at the surface a thin coat of brown oxide, which adheres very strongly to the metal, and will admit of a high polish, giving it quite the appearance of the finest bronze.

Magnesium Steel.—Magnesium also causes a remarkable change of structure in other metals. A coarse-grained steel becomes fine-grained on the addition of one-fifth per cent. of magnesium. In performing the experiments referred to, the magnesium must be introduced through a hole in the cover of the crucible after the oxygen has been first removed by the addition of a few pieces of charcoal. Without this precaution violent explosions are apt to occur.—*Berichte der Chem. Gesellschaft.*

Incombustible Wood.—Mons. M. P. Folbarri claims that he has discovered a method by which wood of any kind can be rendered incombustible. The following chemical compound is said to produce the result:—Sulphate of zinc, 55lb.; American potash, 22lb.; American alum, 44lb.; oxide of manganese, 22lb.; sulphuric acid of 60°, 22lb.; water, 55lb.; all of the solids are to be poured into an iron boiler containing the water at a temperature of 45° C. or 113° F. As soon as the substances are dissolved the sulphuric acid is to be poured in little by little until all the substances are completely saturated. For the preparation of the wood, it should be placed in a suitable apparatus and arranged in various sizes (according to the purposes for which it is intended) in iron gratings, care being taken that there is a space of about half an inch between every two pieces of wood. The chemical compound is then pumped into the apparatus, and as soon as the vacant spaces are filled up it is boiled for three hours. The wood is then taken out and laid on a wooden grating in the open air, to be rendered solid, after which it is fit for any kind of work where there is any liability to destruction by fire.—*Building News.*

Solution for Electro-plating with Copper.—The following recipe is for a solution for electro-coppering iron, lead, zinc, pewter, etc. Weigh out sulphate of copper, one drachm; tartaric acid, two drachms; caustic potash, (in sticks) two drachms. Dissolve the sulphate of copper in about half a tumblerful of water; also dissolve a small quantity of washing soda (about two drachms) in warm water, and add the soda solution to the copper solution. Just enough should be added to throw down all the copper in the form of a green precipitate—basic carbonate of copper. This precipitate has now to be separated from the fluid, which is a solution of sulphate of soda. The quickest way to effect the separation is by filtration, in which a piece of blotting paper folded twice and adjusted within a funnel may replace the usual filter paper. If time be no object, the precipitate may be allowed to subside, and the clear solution afterwards poured off. In either case the precipitate should be washed with clear water in order to remove the last portions of the soda solution. Now dissolve the tartaric acid in a small quantity of warm water; get the moist copper precipitate into a tumbler, and pour the tartaric acid solution upon it. Effervescence will take place. Wait until all the gas—carbonic acid—is evolved; then put the sticks of caustic potash into the tumbler, and add sufficient water to make up at least half a tumblerful—one gill—of solution. The potash dissolves the copper precipitate, the fluid becoming of a beautiful blue colour, without any sediment.—*Electrician.*

Japanese Cement.—Mix the best powdered rice with a little cold water, then gradually add boiling water until a proper consistence is acquired, being careful to keep it well stirred all the time; lastly, it must be boiled for one minute in a clean saucepan. This glue is beautifully white and almost transparent, for which reason it is well adapted for fancy paper work, which requires a strong and colourless cement.

Cutting and Polishing Stones.—In the absence of a lapidary's wheel, the following process (which, however, requires patience), will be found successful:—If the stone is small, procure a good cork, cut a hole at one end, by means of melted sealing-wax or cement, fix the stone in the cork. If large enough to hold in the hand this is unnecessary. In any case procure some moderately fine emery powder, place about two or three teaspoonfuls of it on a piece of hard sandstone (a window stone answers well), and with water grind the stone to be polished until it is quite flat and smooth; next procure a piece of sheet lead, which fasten to a board; on this place some of the finest rottenstone and grind with water until all the coarse scratches produced by the emery are gone; next polish by grinding on a hard Arkansas or Water-of-Ayr stone with water alone till polished. In this way a piece of quartz with a surface of two square inches may be perfectly polished in about four hours. Of course if it is desired to polish more than one side of a stone, this process takes much longer, but it is applicable to nearly all minerals, rocks and precious stones.

(*To be continued.*)

Importations of Clocks and Watches.—During June, 1879, clocks, 63,918, value £40,988; watches, £34,908.

THE

Watchmaker, Jeweller, & Silversmith,

A MONTHLY TRADE JOURNAL,

Devoted to the interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades; published at Milner's Buildings, Moorgate Street (Opposite Moorgate Street Station), London, E.C. Booksellers and Newsagents supplied by Messrs. Catty & Co., 12, Ave Maria Lane, Paternoster Row, E.C.

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Mr. J. H. Johns is the only authorised traveller for this Journal.

Receipts for subscriptions will only be sent when asked for, and on receipt of postage stamp for such purpose.

PATENTS.

United States of America.

213,811. Edward Davies, of Brooklyn, N. Y., for "Crutchos for clock-pendulums."—Application filed 16th October, 1878.

213,833. Ulrich Oppliger, of Chaux de Fonds, Switzerland, assignor to John Bauer, of Petaluma, Cal., for "Stem winding and setting watches."—Application filed 26th December, 1878.

8648. William Haines, of Philadelphia, Pa., for "Adjustable watch-keys."—Patent No. 209,340, dated 29th October, 1878.—Application filed 9th January, 1879.

213,999. Charles Ostrom, of Newark, N.J., assignor to E. and H. T. Anthony and Co., of New York, N.Y., for "Clocks."—Application filed 28th February, 1879.

214,351. John Barclay, of Providence, R.I., for "Bracelet hinge-joints."—Application filed 11th September, 1878.

214,642. Ezra C. Fitch, of New York, N.Y., for "Watch-cases."—Application filed 4th January, 1879.

214,874. Hubert J. Beugnies, of Boston, Mass., for "Bracelets."—Application filed 6th March, 1879.

214,947. John B. Peck, of North Attleborough, Mass., assignor to Henry F. Barrows, of the same place, for "Watch chains."—Application filed 6th March, 1879.

215,057. Henry H. Ham, jr., of Portsmouth, N.H., for "Ships' bells indicating clocks."—Application filed 2nd October, 1878.

215,217. George H. Fuller, of Pawtucket, R.I., for "The manufacture of jewellers' findings."—Application filed 20th February, 1879.

215,235. James W. Miller, of Newark, and Isaac M. Miller, of Orange, N. J., for "The manufacture of jewelry."—Application filed 13th February, 1879.

215,381. Charles Albert Mayrhofer, of Vienna, Austria, assignor to Victor Popp and Ernest Resch, of the same place, for "Pneumatic clocks."—Application filed 1st June, 1877.—Patented in England, 7th February, 1877; in France, 10th February, 1877; and in Belgium, 28th February, 1877.

215,420. Thomas A. Willson and George W. Meigs, of Reading, Pa., assignors to said Thomas A. Willson, for "Spectacles."—Application filed 26th March, 1879.

Belgium.

48,650. A. Lion, for "New jewellery and its manufacture."—Dated 3rd July, 1879.—Original Patent, 25th November, 1878.

Patents granted in British Colonies and Dependencies.

Canada.

10,017. E. C. Fitch, of New York, U.S.A., for "A dust-proof watch-case."—Dated 28th May, 1879.

Patents on which the Stamp Duty of £50 has been paid, and Dates of their Production for Certificate.

3078. John Stuart, of 7, Wigmore Street, in the county of Middlesex Optician, for an invention of "Improvements in microscopes."—A communication to him from abroad by Joseph Zentmayer, of Philadelphia, in the United States of America, Optician.—Dated 1st August, 1876.

3309. Charles Harrold, of Birmingham, in the county of Warwick, Refiner and Metal Roller, for an invention of "Improvements in the manufacture of watch pendants, and in tools or machinery employed in the said manufacture."—Dated 23rd August, 1876.

3356. Frank Moore, of Knowle, in the county of Warwick, Tool Maker, for an invention of "Improvements it solitaires, sleeve links, and other similar dress fastenings."—Dated 26th August, 1876.

Patents which have become Void.

2958. John Alfred Langston, of Tavistock Street, Bedford Square, in the county of Middlesex, Architect, for an invention of "Improvements in illuminating clocks."—Dated 20th July, 1876.

Patents Sealed.

527. Alexander Melville Clarke, of Chancery Lane, in the county of Middlesex, Patent Agent, for an invention of "Improved striking or chiming mechanism for clocks."—A communication to him from abroad by William Lindon, of Brooklyn, in the county of Kings, state of New York, United States of America. Dated 10th February, 1879.

554.—William Wright, of Birmingham, in the county of Warwick, Jeweller, for an invention of "Improvements in scarf-rings, which improvements are applicable to brooches, dress-holders, and such like articles.—Dated 12th February, 1879.

Notices to Proceed.

2795. Henry Port, of Small Heath, near Birmingham, and Theophilus Varley, of Walthamstow, in the county of Essex, have given notice in respect of the invention of "Improvements in electric and other time pieces, and in apparatus connected therewith."

2572. William Winters, of Birmingham, in the county of Warwick, Jeweller, has given notice in respect of the invention of "Improvements in solitaries, studs, and buttons."

Patents Granted in Foreign States.

German Empire.

6679. C. Desprez, of Bristol (England), for "A dial with transparent figures, and hands for night-clocks and compasses."—Dated 25th December, 1878.—Class 83.

6680. E. Dubied, of Couvet (Switzerland), for "An apparatus for fitting watch-glasses and dials."—Dated 22nd January, 1879.—Class 83.

6682. A Leue, of Berlin, for "Bi-partite studs."—Dated 7th March, 1879.—Class 44.

6719. C. Shepherd, of St. John's Wood, Middlesex, for "An electric clock."—Dated 25th December, 1878.—Class 83.

6720. C. F. Milde, of Paris, for "An electric clock-motion."—Dated 31st December, 1878.—Class 83.

6724. F. J. Perkins, of Frome (England), for "A regulator for watches and clocks."—Dated 28th January, 1879.—Class 83.

6726. Siedle Brothers, of Triberg, for "A metal stand for German clocks."—Dated 6th February, 1879.—Class 83.

6728. Pollack and Holtschneider, of Aix-la-Chapelle, for "Securing the pinion of the clock-work of German clocks.—Dated 11th February, 1879—Class 83.

6811. A. Amuel, of Berlin, for "Modifications in microscopes."—Dated 23rd February, 1879.—Class 42.

6878. G. Thommen, of Waldenburg, near Basle, for "A pocket watch."—Dated 15th February, 1879.—Class 83.

Austria.

964. N. Mandl, of Vienna, for "Improvements in the joints of ear-drops."—Dated, 16th March, 1879.—Class 7.

1069. C. Stark, of Mondsee, for "A repeating mechanism for eight-day clocks."—Dated 19th March, 1879.—Class 7.

1079. J. Tetzis, of Galatz (Roumania), for "A clock-work."—Dated 11th March, 1879.—Class 7.—French patent 14th August, 1878.

France.

129,354. Cadot, of Paris, for "A transmission, applicable to so-called 'mysterious clocks.'"—Dated 1st March, 1879.—Class 12.

129,383. Belzon, of Le Rassey, for "Economical clock-work."—Dated 20th March, 1879.—Class 12.

129,437. Mrs. Voisard, for "Improvements in escapements of travelling and other clocks."—Dated 6th March, 1879.—Class 12.

129,449. Redier, of Paris, for "Clocks with or without alarms."—Dated 7th March, 1879.—Class 12.

122,987. Nemitz, for "A magical luminous dial."—Dated 3rd March, 1879.—Class 12.

123,125. Bellair and Co., for "A kind of gold chain."—Dated 7th March, 1879.—Class 17.

Grants of Provisional Protection for Six Months.

2572. To William Winters, of Birmingham, in the county of Warwick, Jeweller, for the invention of "Improvements in solitaries, studs, and buttons."

2989. To John Price Hunt, of Birmingham, in the county of Warwick, Jeweller, for the invention of "Improvements in or relating to ear-rings, ear-studs, necklets, chains, and bracelets, applicable to other ornamental and useful articles or appendages."

3017. To Alexander Melville Clark, of 53, Chancery Lane in the county of Middlesex, Patent Agent, for the invention of "Improvements in keyless watches."—A communication to him from abroad by Pauline Gontard, of Cortébert, Switzerland.

3019. To Thomas Southgate, of Burton Crescent in the county of Middlesex, Gun Maker, for the invention of "Improvements in the construction of wrist and other studs or solitaires."

3055. To Jacob Merzbach, of Holborn Viaduct, in the city of London, for the invention of "An improved calendar clock movement."—A communication to him from abroad by Erhardt Junghans and Arthur Junghans, both of Schramberg, Germany.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Davis, Harris, Park Street, jeweller. July 31. A. B. East, sol., Temple Street, Birmingham.

Hearn, William, Stroud Green Road, jeweller. Aug. 6. J. Harrison, sol., 172, Bermondsey Street.

Kember, William Henry, trading as Kember & Sons, Camden Road, Camden Town, Westgate and Broadstairs, Kent, late Dulwich, prev. Clerkenwell and Goswell Road, jeweller. July 29. S. T. Cooper, sol., 88, Chancery Lane.

Kramm, John, Fleet Street, and George Street, Torquay, watchmaker. Aug. 6. T. C. Lindop, sol.

Leighton, Thomas, William Edward Leighton, and Francis Henry Leighton, trading as Thos. Leighton & Sons, Birmingham and Coventry, watch material manufacturers and tin plate workers. Aug. 5. J. C. Fowke, Ann Street, Birmingham, sol.

Lumley, John, 45, Cooper's Road, Old Kent Road, late St. Martin's Road, Stockwell, jeweller. Aug. 6. Goldberg & Langdon, sols., 1, West Street, Finsbury Circus.

Sanders, Charles, Albion Street, Birmingham, and The Hollies, Four Oaks, Sutton Coldfield, gold locket maker. Aug. 7. Tyndall & Deakin, sols., Birmingham.

Winteralder, Alois, Devonshire Terrace, Notting Hill Gate, late Connaught Street, Hyde Park, watchmaker. Aug. 9. At H. H. Myer's, sol., 31, New Bridge Street, Ludgate Hill.

Draper, Henry, and Edward Thomas Stewart, trading as John Turner & Co., New Bond Street, jewellers. Aug. 14. At Munns & Longden's sols., 8, Old Jewry. Sept. 10 at 1.

Draper, Henry, New Bond Street, jeweller (sep. creditors). Aug. 14. At Munns & Longden's, sols., 8, Old Jewry. Sept. 10 at 3.

Honeybone, Richard, Luton, Beds, jeweller. Aug. 15. G. M. Wetherfield, sol., Gresham Buildings, Basinghall Street.

Hunt, Isaac, New Swindon, Wilts, dealer in jewellery, &c. Aug. 8. Kinnear & Tomb, sols., Swindon.

Merchant, George Allen, Cavendish Street, Ashton, jeweller. Aug. 11. G. P. Fripp, sol., Oldham.

Mudon, John, Gloucester Road, South Kensington, jeweller. Aug. 1. Munton & Morris, sols., Lambeth Hill, Queen Victoria Street.

Medley, John, Otley Road, Bradford, jeweller. Aug. 20. Hodgson & Haigh, sols., 13, Waterloo Street, Birmingham.

Meredith, Joseph, Trinity Terrace, Radford Road, and Bishop Street, Coventry, watch manufacturer. Aug. 19. O. Minster, sol., Coventry.

Lombardini, Francis Napoleon Bernardo, Longbrook Terrace, Exeter, late Newton Abbot, watchmaker. Aug. 23. At R. Southcott's, 1, Post Office Street, Exeter. Sept. 8 at 10. T. W. Hartnoll, sol.

Whalley, William Henry, Victoria Street, Blackburn, jeweller. Aug. 19. O. Polding, sol., Blackburn.

Dividends.

Taylor, Dickinson (Liq.), Bacup, watchmaker. First and final div. 8d. S. Atherton, Waterfoot, near Manchester.

Trustees Appointed.

Bryan Edward (Liq.), India Buildings, Manchester and Cheetham, optician. Tr., S. Murray, Brazennose Street, Manchester, accountant.

Maitland, John M. (Liq.), Ulverston, jeweller. Tr., H. Crook, Ulverston, high bailiff.

Allen, William A. (Bkt.), Cardiff, watchmaker. Tr. W. C. Clarke, Cardiff, Accountant.

Davis, David J. (Bkt.), Elizabeth Street, Cheetham, Manchester, jeweller. Tr., J. M. Banks, Northampton Street, Birmingham, jeweller.

McElroy, Francis (Liq.), Corporation Street, Manchester and Longsight, optician. Tr., H. Vaughan, Princess Street, Manchester, accountant.

Dissolutions of Partnerships.

Spiegelhalter & Co., Mount Place, Whitechapel, jewellers. Aug. 11.

Williams, Josiah & Co., 18, St. Augustine's Parade, Bristol, manufacturing silversmiths. Aug. 1. Debts by George Maudasly Jackson.

Last Days for Lodging Claims.

Wray, William (Bkt.), Tyrrel Street, Bradford, watchmaker. Claims by Sept. 15 to W. Miles, Vyse Street, Birmingham, jeweller.

THE PRINCE IMPERIAL'S WATCH.

"We find in the columns of a German contemporary," says the *Standard*, "some interesting details concerning the watch which the Prince Imperial wore on the day of his death, and which is now in the hands of the Zulus. The watch is said to have belonged to the First Napoleon, and to have been prized much above its intrinsic worth by him, from the fact of its having borne him company in the majority of his glorious campaigns. He had purchased it at Marseilles when he was but a lieutenant in the artillery, and notwithstanding its poor claims to be a good watch, its constant need of reparation, the indifferent time it kept, its owner would never consent to use any other than this, which told the time of day and night to Napoleon the Consul, Napoleon the Emperor, Napoleon the captive at St. Helena. Subsequently the watch became the property of Napoleon III., who, prizing it for the sake of its illustrious purchaser, had it in constant use from the day he was named Prince-President to that on which he breathed his last at Chislehurst. He wore it on his Boulogne and Strasburg expeditions, and during the disastrous Franco-Prussian war. The story goes, that in 1870, just as Napoleon was on the point of starting to put himself at the head of his troops, the watch suddenly stopped. The Emperor was superstitious, and seeing in this not uncommon incident an unlucky presage, he remained depressed and gloomy during several subsequent days. When death claimed him at Camden House, his widow, the Empress Eugenie, gave the watch, to which so many *souvenirs* were attached, to her son, as a remembrance of his father and great uncle. The Prince Imperial wore it on his first and last campaign, and now this historical relic of a great family has, by the fortune of war, fallen into the possession of King Cetewayo's half-savage warriors."

GLEANINGS.

Geneva is to have a permanent exhibition of watches and jewellery.

Mons. Raspail, a Deputy in the French Chamber, proposes to sell the "Crown diamonds." The Radical Deputy no doubt thinks the ready cash would be more useful just now, but we should advise him not to realise too hastily, as they might be wanted again.

The Right Hon. W. E. Gladstone opened a fine art exhibition at Chester, on the 11th ult., in aid of the funds of the local School of Art. In the course of his remarks the right hon. gentleman said:—"I do not think that in the art of designing for silver plate we have made the same advances as we have made in designing for glass and porcelain, but the beautiful works that Messrs. Elkington have sent to this exhibition (I know not whether there are others of the same kind) will show you that in that also improvement is at work. But do not suppose that because improvement is at work therefore there is no more to do. We want to carry this work of improvement to such a condition that it shall not depend upon the spirit or enterprise of this or that master, of this or that workshop or factory—we want to get it into the mind and brain and heart and feeling of the working men."

We hear that Mons. Cl. Saunier is preparing an appendix to his celebrated Treatise on Modern Horology. This valuable supplement will also be added to the English edition, now in course of publication.

The Sydney (New South Wales) branch of the Royal Mint has received 11,546,463.95 ounces of gold for coinage since its opening in 1851 to the end of 1878.

A jeweller advertises that he has some precious stones for disposal; adding that "they sparkle like the tears of a young widow." Of course, this is in America, where they know how to advertise.

Great distress prevails in the watch-making districts of the canton of Neuchâtel (Switzerland), owing to the depression in the trade.

Mr. Crookes, while reading a paper on Radiant Matter, before the British Association at Sheffield, made several striking experiments, showing the quality of phosphorescence induced by a radiant discharge. The diamond was shown to be, in this respect, the most sensitive substance. A fluorescent diamond was exhibited, which is green by daylight, and colourless by candle-light. It was mounted in the centre of an exhausted bulb, and a molecular discharge directed upon it. Then, on darkening the room, it shone with as much light as a candle, phosphorescing of a bright green.

Mr. Tracy Turnerelli has at last made a very sensible suggestion for the disposal of the "People's Tribute." He recommends that it should be handed over to one of our great national museums, to be preserved in a suitable and costly case, as a specimen of English goldsmiths' work of the nineteenth century. The wreath, according to Mr. Turnerelli, is considered by "high academic judges" to be the finest work of goldsmiths' art that England ever yet produced, and that it might justly compete with the "most exquisite works of Benvenuto Cellini." We should, however, like to see something of this wonderful piece of work, or at least hear the names of some of those "high academic judges," before we are ready to admit its high pretensions. Supposing the wreath to be really such a *chef-d'œuvre* as represented, it should be deposited in the South Kensington Museum; and in that case Mr. Turnerelli's "unheard of exertions" will not have been in vain; but if the object for which it was originally intended, and the notoriety it has gained are its chief attractions, it had better go "as a curiosity" to Madame Tussaud's, as suggested by some of the comics.

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THE
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TRADE
JOURNAL.
W. H. TILBY

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

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CONTENTS.

	PAGE
Horology	41
New Weights and Measures' Act	42
The International Watch Company	42
Practical Instructions to Jewellers, Silversmiths and Electro-platers	43
Prices Current for Gold and Silver	43
Jewellery	44
The Silver Trade	45
Bronzes	46
Hints to Repairers	47
Curiosities of Clocks and Watches	48
Queries and Answers	49
School for Jewellers	49
Messrs. Christofle & Co.'s Plating Works in Paris	50
Trade Recipes, &c.	51
Patents	52
Monthly Record of Bankruptcies	53
More Swindle in the Watch Trade	53
German Watchmakers' Society	54
Important Sale of Jewels	54
Directory	ii
Advertisements	i-x

No. 53.—Vol. V.] OCTOBER 6, 1879. [Subscription, 5s. per Annum. Post Free.

HOROLOGY.

(*Continued from page* 28.)

XLV.—Correct Epicycloidal form of Wheel Teeth.

A SPECIAL depthing tool is provided for the new rounding-up cone which we introduced in our last; my other depthing tool may be used with equal satisfaction. This depthing tool is, however, only half the price of an ordinary one, and being made for the purpose, the work may perhaps be done with greater accuracy; besides this, there is also an appendage called a cone carrier, which may be used in the place of the T-rest of any ordinary Swiss bore lathe, without any previous preparation. The following is the manner in which the tool is used:—

The cone being placed upon a loose arbor running between the centres of the depthing tool, a cone carrier, is set in gear with the wheel to be rounded up, just like a pinion with its wheel; these are simply set in motion with a string bow, and it is immaterial whether the bow is applied to the wheel or to the cone; thus the work proceeds. Naturally the operation is begun with a shallow depth, and as the tool is closed by degrees, making the gearing deeper, little pieces are seen to fly off, cut just as neatly as if a cutter wero employed. After a few strokes with the bow the work is completed, and the teeth will appear brilliant, regular, and polished in the highest degree. An essential point is the choice of the proper cone, but nothing is more simple. The operation is commenced by putting the cone and the wheel together at a point where their depth is good; that is to say, like that of a good pinion and a good wheel well set; in other words, a point in the gearing is chosen where the teeth of the cone and those of the wheel being equal, there is no butting or fall, neither at the entrance of the teeth, nor at their exit. There is hardly a workman who will not instantly comprehend these details. This being done, the wheel is moved a little towards the small end of the cone, so that there will be a butting against the sharp angles of the teeth of the cone (which will become progressively smaller with respect to these of the wheel), and the work begins. It is by this colliding of the sharp cutting angles of the cone with the unrounded portions of the teeth of the wheel that the former gives to the latter the desired shape.

After the first few strokes, if it is desired to obtain a still more perfect result, *i.e.*, a more decided curve, it will be only necessary to bring the wheel still a little further towards the small end of the cone, setting them in motion anew, and closing the depth progressively. Care must be had to cease immediately upon the disappearance of the last vestiges of the flat at the points of the teeth of the wheel. If the operation were continued, the teeth would become disfigured, and instead of an epicycloidal curve there would be but a rough and uneven surface. This is evident, that in overstepping the proper limits a bad result would be obtained, like that of a wheel in gear with too small a pinion. For similar reasons, but diametrically opposite ones, if a cone were used at a place where its teeth would be larger than those of the wheel, instead of rounding them up it would disfigure them. It is scarcely to be feared that any workman will commit these extreme errors, yet it seemed necessary to point out these chances of trouble in the way of a precautionary admonition.

When the work is brought to the point above mentioned, if it is desired to obtain the highest degree of perfection, the wheel is replaced, turning it end for end between the centres of the tool (lathe or depthing tool), and it is set in motion anew, with the cone at the exact place where it was before. This short operation consists of two or three strokes of the bow; after this, the wheel is brought a little towards the larger end of the cone, about to the place where the operation was commenced, and a few drops of oil put to the teeth of it; then give about five or six light strokes with the bow, guiding the motion of the wheel with the end of the finger, and the whole work is done. The wheel is to be stoned off on both sides, washed and cleaned, and then with the glass it can be verified that no polish with rouge equals that in the rounded-up teeth done by this process. This polish is the more perfect, as the acting surfaces are cut lengthwise in the teeth, which is an improvement on the ordinary rounding cutters, which leaves, of necessity, the lines cut crosswise.

Recent improvements have added an important property to these cones, which permits of varying the form of the teeth according to the desire of the operator. The sides of the leaves of all the cones are very delicately cut longitudinally like a file, so that they abrade like exterior sharp angles, and thus act upon the teeth. This enables the operator to operate only with the sides of the leaves, as, for instance, when it is desired to re-touch a wheel which has already been rounded-up, and thus to make with certainty re-touches of infinite delicacy without running the chance of overdoing it, even should the operator be entirely a novice in the management of the tool. For this purpose, the cone and the wheel must be put together precisely at the place where there is no butting or colliding, nor fall, and where their gearing is that of a good wheel and pinion, properly set, as before explained; then, after having put a drop of oil to the points of contact, they are set in motion, and the work is being accomplished as the depth is closed by degrees.

If it is desired to obtain a less oval shape of the teeth, such as is required for the pinions of low numbers, it will suffice to bring the wheel successively toward the smaller end of the cone, being careful that it be not overdone, so that the outer sharp corners of the cones commence to cut. Thus is realised the power of proportioning the form of the teeth to the number of leaves in the pinions employed. The use of these cones in the most celebrated houses abroad has given the very best results. In the Paris house Bréguet, trains of telegraph apparatus have been brought to working perfection unheard of. If necessary, it will operate on and round-up wheels of a thickness of one-fifteenth of a millimetre, and the pitch of which it from three to four millimetres. This is certainly the maximum of large work. In the same firm an extreme sensibility has been obtained for aneroid barometer. The teeth of a wheel to be rounded-up were those of one not exceeding three millimetres in diametre, and the pitch of which was three-tenths of a millimetre. This was incontestably the minimum of small and delicate work. It need hardly be said that all these operations must be performed with a care and delicacy usual in practical horology. Generally it is preferable to apply the bow to the pulley in the cone, with the precaution to make the bow as long as possible, and string with horse-hair or a fine silk cord. This silk cord, particularly when well waxed, is of great flexibility, and lasts five times as long as a gut.

(*To be continued.*)

NEW WEIGHTS AND MEASURES' ACT.

We wish to remind the trade that the above Act came in force on the first of July last, and that the penalties for using illegal weights will be duly enforced. The following correspondence which appeared in the *Pawnbrokers' Gazette* will be of general interest:—

"38 and 39, Gracechurch-street.
"September 10th, 1879.

"Dear Sir,—Kindly inform us if it is compulsory that we should weigh all gold, silver, and diamonds, and also print all weights in our catalogues, according to the New Weights and Measures' Act (decimal system), or can we use the old weights (dwts., grs., etc.) at pleasure, and oblige,

"Yours respectfully,
"Johnson and Dymond.

"The Inspector of Weights and Measures, Guildhall."

"Weights and Measures' Office, Guildhall, E.C.
"September 10th, 1879.

"Gentlemen,—In reply to your note of to-day, I have to inform you that by the Weights and Measures' Act, 41 and 42 Vic., cap. 49, the only legal weights that can be *used* in trade, and *stamped* by an Inspector, are those mentioned at page 33, the second schedule of said Act.

"Sec. 19 imposes a penalty not exceeding 40s. for each sale by any denomination of weight other than one of the Imperial Weights, and sec. 29 a penalty not exceeding £5 for using or having possession for use for trade any weight not so stamped by an Inspector.

"Sec. 23 refers to any person printing or making any return, price list, etc., with a fine not exceeding 10s. for every copy of such return, price list, price current, journal, or *other* paper which he publishes. The penal clauses of the Act came into force on the 1st July last.

"Gentlemen, yours respectfully,
"John F. Johnson, Inspector.

"Messrs. Johnson and Dymond, 39, Gracechurch-st., E.C."

THE INTERNATIONAL WATCH COMPANY.

Powerful competition, to which the watch trade is as much exposed as any other industry, has necessitated the introduction of such methods of manufacture as tend to lessen cost of production; costly hand labour has, therefore, been to a great extent supplanted by machinery, and the result is that we have now time-keepers possessing even certain advantages over those made under the old system, at a price reduced by at least one-third. This is certainly progress, and it is equally certain, in spite of many assertions to the contrary, that, for general use, the machine made watch is the watch for our times.

We have just had an opportunity of examining some of the products of the above company, which manufactures on the American (interchangeable) system, and we are compelled to acknowledge that their goods represent still further progress. *Cheap and bad* are no longer synonyms; here we have a most carefully constructed and finished watch, a thorough time-keeper of attractive appearance, at a price which brings "correct time" within the reach of the most slender pocket. The International Watch Company manufacture every kind of movement; but a speciality, deserving special attention, is their three-quarter plate keyless watches in hall-marked gold and silver cases. The Company enjoys already a good share of patronage, and employs nearly 200 hands. The London Agency is at 10, Thavies Inn, Holborn Circus, London, E.C.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. VI.

(*Continued from page* 29, Vol. 5.)

Cleansing Zinc—*continued.*

It often happens that the lines of tin or lead solder are black after being dipped into the acid bath, it is then sufficient to scratch-brush before placing the object in the electro-plating solution. Zinc may be slightly amalgamated with the solution of nitrate of binoxide of mercury, which we have recommended for copper; this increases the adherence of the electro deposits. It is often necessary, from some defect in cleansing, or in electro-plating, which impairs the adherence of the deposits, to do the work over again. In such a case, it is advisable to remove the copper entirely by plunging the object into aquafortis and soot, until it appears black. Another dipping into the compound acids will render it perfectly clean and white, and ready to receive a new deposit. If the copper has been deposited too thickly it becomes very difficult to remove, and the article is generally spoilt in the operation, because the zinc pits in the parts first stripped of the copper.

Cleansing Lead and Tin.—Tin, lead, and the alloys of these metals are much more difficult to cleanse than zinc. A rapid scouring with potash lye, a rubbing with a hard substance, are the only means of effecting this. The objects are sometimes plunged into diluted hydrochloric acid, but the first operation is nearly always necessary. Notwithstanding the greatest care, the direct deposit of the precious metals is difficult, and does not adhere well. The results are much better if a coat of pure copper or brass is interposed between the low metal and the gold or silver.

Cleansing Cast Iron.—Cast iron is cleansed by being immersed for two or three hours in water containing one-hundredth part of sulphuric acid; the metal is afterwards rinsed in cold water, and scoured with sharp sand and a fibre brush, or a coarse linen rag. It is then put again in the acid pickle, rinsed, and lastly plunged into the electro bath. If more than 1 per cent. of sulphuric acid is added to the water, the length of the immersion must be shortened, otherwise the cast iron will be deeply corroded, the iron dissolves and leaves nothing but the carbon of the metal on the surface. The latter is insoluble in the pickle, and it requires a great deal of rubbing with sand to bring up a fresh metallic surface. Good results are never obtained when cast iron has been subjected to too energetic or too prolonged a bath.

Cast iron does not take a gold deposit well by direct deposition, and one of silver still less, neither will it take copper and brass easily, although it can be accomplished by several scratch-brushings and repeated immersions. A method of tinning cast iron will, however, be described in the course of these articles, to enable operators to give this metal a coating which will readily receive deposits of copper and brass, securing perfect surfaces for gilding and silvering. Some operators prefer hydrochloric to sulphuric acid for cleansing cast iron, but it requires 5 per cent. of the former to 1 per cent. of the latter; the operation becomes thus more expensive and less certain. We are convinced, from experience in establishments where thousands of kilogrammes of cast iron are daily cleansed for tinning, that 1 per cent. of sulphuric acid dissolved in water, forms a bath capable of doing good service for eight days, and at the end of that time another hundredth of acid need only be added to restore its force for fresh work. We prefer a pickle already used, and therefore charged with sulphate of iron to a new one, because the former attacks the cast iron more uniformly.

The same cannot be said in favour of hydrochloric acid, as its volatility causes it to evaporate with the hydrogen freed during action, and the bath naturally soon loses its power. If it is desired to keep cast iron already cleansed for some time before submitting it to the plating solution, it is necessary to preserve it in a liquor rendered alkaline by caustic lime, potash, or soda, or their carbonates; but caustic lime-water is the most economical preservative, and cast iron which has remained in it for a few hours will not rust, even after a prolonged exposure to a damp atmosphere.

Cleansing Wrought Iron.—Wrought iron is cleansed in the same manner as cast iron, but will bear a stronger pickle and a longer immersion. We speak here of ordinary wrought iron, generally covered with a black or red oxide. Whitened or polished iron we class with steel, and must be treated like that metal.

Cleansing Steel.—Polished articles of steel or iron must be first cleansed in a boiling solution of caustic lye, and rubbed with pumice-stone dust, which roughens the polish slightly, and thus produces a better hold for the metals afterwards to be deposited. They are then rapidly passed through a bath composed of:

Water	1 quart
Hydrochloric acid ., ...	12 ozs.
Sulphuric acid	4 ozs.

A thorough rinsing in cold water is indispensable before immersion into the plating solution. On no account must nitric acid be substituted for the hydrochloric or sulphuric in the preparation of the above bath.

Iron and steel may be well gilt without an intermediary coat in hot gilding baths, which will be dealt with when we come to the preparation of the various plating solutions. Direct deposits of silver on steel are, on the contrary, always more or less imperfect. Various methods for direct silvering are indicated in works on electro-metallurgy, but we can assure our readers that none of them are satisfactory. The adherence of the silver is in most cases of but short duration. To overcome this difficulty, it is usual to give steel and polished iron articles a previous coating of copper or brass. The deposition of copper, brass and tin, is, therefore, in the case of a number of metals, the final operation in the cleansing process; but before proceeding with the description of these manipulations, we shall have something to say of that marvellous instrument, the electric battery.

(*To be continued.*)

The works executed by the pupils of the Glashutte School of Horology, consisting of models of movements, balances, etc., are to be disposed of by lottery, for the benefit of that institution.

A prisoner was sentenced at the Liverpool Sessions to twelve months' imprisonment for sweating sovereigns, and reducing them in size by one twenty-fourth. The recorder said in a short time hundreds of sovereigns had found their way into the bank which had a new milling substituted for the genuine one.

Prices Current for Gold and Silver.—Value given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver 4s. 6½d. to 4s. 9d. (variable according to quantity).

JEWELLERY.

By George Wallis.

(*Concluded from page* 31.)

At the conclusion of our last article, we quoted some statistics from "The Resources, Products, and Industrial History of Birmingham and the Midland Hardware District," by Mr. J. S. Wright, of Birmingham. The same authority gives the following abstract of the number of persons engaged in the jewellery trades as a whole:—

Masters	500 to 600
Jewellers proper	3,000
Silversmiths	1,000
Gold and silver chain makers	1,500
Gilt toy makers	1,000
Box makers, die sinkers, and subsidiary trades...	1,000
Total	7,500

Recent inquiries have led me to the conclusion, from information received on trustworthy authority, that this number is now increased to ten thousand, each division having been extended in proportion, and that at the present time there is no single industry in Birmingham in which so many are employed.

As regards the value of the precious metals consumed annually by these trades in that town, £850,000 worth is considered by those best acquainted with the subject as a low calculation, and it is probably nearer a million's worth. The value of the annual consumption of silver is calculated at £75,000. In the matter of the consumption of precious stones, we cannot give a better illustration than that afforded by Mr. J. S. Wright in the report already quoted. He says:—"Forty years ago there was one stone dealer in Birmingham, and now (1865) there are thirteen. Doubtless the most valuable diamonds are set in London, but the greatest number are used in Birmingham. An ordinary manufacturer will produce ear-rings containing upwards of a hundred diamonds, besides a quantity of brilliants; and it is no uncommon thing for rings to be set in Birmingham with diamonds of the value of £100 and upwards. Several manufacturers will keep a stock of diamonds, the value ranging from 5s. to £50 each, and worth £1,000 to £2,000 in the aggregate." Mr. Wright then goes on to state:—"A very great rise has taken place in the value of diamonds during the last twenty years, and within the last four or five years emeralds and other precious stones of fine quality have more than doubled in value. Sorts selling formerly at £3 to £4 per carat now fetch £10 to £12; amethysts that were worth 50s. per ounce are now worth £8 and upwards; and it is estimated that the consumption of diamonds has increased tenfold within fifteen years in Birmingham."

It will be at once conceded that with such a condition of things in 1865, values and consumption have increased during the last seven or eight years in proportion probably to the increase of the jewellery trade itself, as illustrated by the numbers already quoted.

Before concluding this brief exposition of the present condition of the art industry under consideration, as practised at Birmingham, it may not be uninteresting to state as an illustration of its position in the middle of the latter half of the last century, that up to 1773 Birmingham had no Assay Office, and all the work done in gold and silver up to that time had to be sent to London or elsewhere to be stamped. In August, 1773, the Assay Office was opened, an Act of Parliament having been specially obtained to legalize such an establishment, in spite of the most determined opposition of the Goldsmiths' Company of the City of London. It was shown as an evidence of the necessity for an Assay Office, that the gold and silver work, plate and jewellery then made in Birmingham exceeded the total which was produced by Chester, Exeter, Newcastle, and some other less important towns, all of which had Assay Offices within their own boundaries. The course adopted by the London Goldsmiths' Company was simply that which is patent to all monopolies, which, as usual, corrected itself in due course.

It would be a perfectly hopeless task to attempt to give any statistical information as to the real extent of the jewellery trades of the metropolis. The only approximation which we can make upon a trustworthy basis is in relation to Clerkenwell, and the figures, though derived from a well-informed source, are more or less conjectural. It must, however, be distinctly understood that the localities represented by these figures are a very considerable extension of the "Clerkenwell" of the end of the last century and commencement of the present. At the latter period, the manufacturers of the district were confined within the space running from the northern boundary of the City of London, and a portion of St. Sepulchre's and the Charterhouse districts, going westward up Turnmill Street and Coppice Row, to the south side of Exmouth Street on the north, passing the vacant ground now occupied by Myddleton Street, to Northampton Square, being bounded on the east by Goswell Street and Goswell Road. Hatton Garden, from its contiguity to the City, was the place of residence of the leading people of Clerkenwell, manufacturers and merchants, as it is now the centre of distribution; not only for the skilled trades of that locality, but for the kindred industries of Birmingham and its surrounding district.

As a matter of course, the extension of the local trades led to encroachments on districts previously free from manufactories of any kind, and now Clerkenwell industries are carried on at Pentonville and Islington. The following figures may be taken as the nearest obtainable approximation to the numbers employed in the special branches of jewellery and kindred trades within the district indicated:—

	Masters.	Workmen.
Jewellers	160 ...	500
Goldsmiths	36 ...	400
(Many masters use these terms interchangeably.)		
Gold chain makers ...	33 ...	180
Gold chasers	24 ...	95
Mourning and wedding ring makers	5 ...	40
Engravers—seal and heraldic	12 ...	36
Gilt jewellers	5 ...	30
Jet ornament manufacturers	7 ...	30
Die sinkers	12 ...	30
Refiners	12 ...	46
Flatting mills	4 ...	40
Jewel-case makers ...	22 ...	90
Shop fitters	10 ...	30
Total	342	1,547

In thus dealing with jewellery as an art industry, it was necessary for the sake of conciseness, and a proper apprehension of its importance in a national sense, to concentrate attention on the localities in which it stands out as a staple trade. Of course in most large cities, notably Edinburgh, Glasgow, and Dublin, there are jewellers as well as other workers in the precious metals, and there can be no doubt that the works executed in these places are frequently of a high character as regards workmanship, and far from deficient in the elements of sound taste.

Viewed commercially, the importance of the jewellery trade is by no means to be overlooked in the overwhelming character of the national exports generally. A large trade has sprung up with the colonies of Australia, some of which have recently imposed fiscal restrictions on personal ornaments as luxuries. The trade in jewellery with the United States would be undoubtedly very large, but for the protective tariff which effectually shields the manufacturers of Connecticut from any competition. The trade in personal ornaments manufactured in England may therefore be considered as essentially a home and colonial trade, and as regards foreign competition it does not assume a shape in any way inimical to the best interests of the native producer; on the contrary, foreign designs tend to stimulate the ingenuity and art skill of the designer and workman, as also to provoke the competition of the capitalist and the manufacturer.

THE SILVER TRADE.

THE following letter appeared in a recent issue of the *Sheffield and Rotherham Independent*:—

To The Editor.—The question of the duty on silver plate is one that has been gradually attracting the notice of the British public, and the recently issued report of the Parliamentary Committee which sat during the past session for the purpose of taking evidence, enables anyone interested to get a clear insight into the working of a fiscal arrangement which has at present no parallel in this country. By the kindness of Mr. Watherston, who has been the chief means of stirring up this question, two copies have been supplied to our Free Library, and all who are interested in a trade that has long been an important one in Sheffield would do well to look over that report, and to consider what it is likely to lead to in the future of the trade.

After hearing evidence from various sources, some opposed to, and others in favour of, the retention of the silver duty, the committee, with only one dissentient voice, came to the conclusion that they would recommend the Government to abolish the duty on silver as soon as the state of the revenue would admit of the operation.

But there is a second question mixed up with that of the silver duty, and which must be considered separately; that of compulsory hall-marking. For several centuries it has been illegal to sell silver goods unless they have been assayed and then stamped, as a proof that they are made of sterling silver, which consists of 925 parts of that metal to 75 parts of alloy, which is mixed with the silver to harden it for successful working. For affixing this mark of the genuine standard product a small charge of a few coppers per ounce is made; it is quite a separate affair from the Government duty, and should not be confounded with it. The silver duty is of comparatively recent origin, and was put on at a time when everything was taxed, even to the light of heaven, in the shape of a window duty; it is the last survivor of a host of duties which, forty years ago, bore heavily on the industry of the country, and it amounts to between 30 and 40 per cent. of the cost of the raw material.

The committee, which was almost unanimous in advising the abolition of the duty on silver, voted by a majority of one, for retaining the practice of compulsory hall-marking.

Those who are old enough to remember the time previous to Sir R. Peel's great measures for the abolition of those excise and customs duties which bore so heavily on the industry of the country, and who have watched the course of events since, need not be reminded of the great expansion that has taken place in certain trades which were previously hampered and shackled by excise duties, and, what were even worse in their operations, excise regulations. No trade suffered more in that way than the glass manufacture, and it remained a stunted and comparatively inexpansive one till the exciseman ceased his calls, and the trade was left free to do whatever seemed best for its interests.

In 1851, the Messrs. Chance of Birmingham, who took the contract for glazing the ever memorable Crystal Palace in Hyde Park, had to send to Belgium for workmen to make the kind of glass needed for their purpose; but last year in the Paris Exhibition, English glass surpassed all competitors, both in the quality of the material, and in the application of art work in its decoration, so that to the firm of Webb, of Stourbridge, was awarded the grand medal of honour in its class.

The silver manufacture, with the exception of some small classes of articles in gold, is the only one on which the Government now levies an excise duty, and it is in evidence that the quantity of sterling silver worked up into the form of plate has dwindled from 1,633,014 ounces in the year 1825 to 790,759 in the year 1878, and this at a time when the wealth and the luxurious habits of the people have expanded with an unprecedented rapidity.

It may as well be stated that no silver plate of foreign manufacture can legally be sold in England without being first assayed and marked with an English hall-mark, and that the regulations for the purpose are so vexatious that, practically, no foreign plate finds a market among us. Various reasons have been assigned for the want of expansiveness in the trade, but the chief seems to be the great increase in the use of electro-plate; but it is difficult to reconcile this with facts spoken to by American witnesses, who state that there has been there a remarkable and rapid growth in the use of sterling silver goods, for not only are the wealthy private citizens discarding the use of plated goods, but even the hotels are making the like change, and not only are they using the more costly material, but they are decorating it at a greater outlay for skilled workmanship than is the usual practice in this country. Their best articles are being sold on their merits and not at so much per ounce. One result has been that a New York house took the grand medal over the heads of the most famous English and French houses at the late Paris Exhibition. That house has now abandoned the manufacture of electro-plate, and confines itself to sterling silver goods.

That the recommendation of the committee will become law by a vote of Parliament when the trade of the country revives can admit of little doubt. May we not entertain a hope of seeing a languishing trade, which is now so heavily taxed, expand as the glass trade did a generation ago, and take its place among those in which Englishmen successfully vie with all comers whether from the Old or the New World?

That they will yet do so is the firm belief of

An Old Hand.

In 1760 it is said that table-spoons began to supersede those of wood, horn, and pewter, in this country. Silver teaspoons were rare before the time of Queen Anne. Silver forks, spoons, ladles, etc., were wrought upon the anvil in the manner of steel wares, or, in some sorts, pierced out of sheets by means of the fly, and afterwards fashioned by striking in bosses and filing.

The St. Petersburg papers report a great development of the gold production of Russia. Strata containing gold in considerable quantity have recently been discovered in the Ural Mountains. It is said that in the district of Sennigsei, a Russian proprietor has found in his gold mine, near Motygyme, a nugget 445 lb. in weight, representing a value of nearly £15,000.

BRONZES.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 34.)

SUCH records prove the extensive and varied use of all these metals, iron included, by people whose civilisation was far below that of their conquerors; and, further, that from its abundant use in so many ways the knowledge of bronze must have existed for previous untold ages.

The series of weights in bronze, formed as lions, the heavy fetters, and the bowls of bronze ornamented with figure and other subjects in beaten work, which are preserved in the British Museum, prove the familiarity of the Assyrians with all the *technique* of bronze handicraft. That museum is rich also in specimens of cast and beaten bronze of Egyptian manufacture, to some examples of which we have already referred. It is, however, to be borne in mind that up to the present time we have no evidence of the power to produce works of colossal or even of large size by casting, either in Assyria or in Egypt. But in the seventh chapter of the first book of Kings, we read how Solomon fetched Hiram out of Tyre, a worker in brass, who executed extensive and varied artistic works for the Temple, among them the "molten sea, ten cubits from one brim to the other," and how they were cast "in the clay ground between Succoth and Zarthan."

There can be little doubt that the arts of the Etruscans were to a certain, although perhaps limited, extent influenced by communication with Egypt and the East, directly, or through the intercourse of the Phœnicians; at the same time it must be borne in mind that the Pelasgian and Tyrrhenian elements were strongly imbued with an archaic orientalism. But beyond and independent of all this, Etruscan art has a marked individuality of character; and it is more than probable that the knowledge of ordinary and artistic metal work, particularly in gold and bronze was, with other arts, indicative of a widely-spread civilisation possessed by that remarkable people at a very remote period. It would seem also that at a time when Greek art was escaping from the rigid formula of the archaic style, the more traditional manner of the Etruscans, probably controlled by priestly influence, led them to keep to the earlier forms until a much later age. We find accordingly that in the contemporary works of the two peoples, those of the Etruscan would frequently seem to be of an anterior date. The progress of Hellenic influence communicated through the Grecian colonies of Southern Italy was irresistible; and the later works of the Etruscans, though still generally retaining a certain rigid mannerism and individual character, were hardly to be distinguished from some of the less advanced productions of the Grecian schools.

History fails us in respect to the oldest works of the Etruscans, as we have yet to learn their exact origin and their language. Their knowledge and great excellence in bronze casting was indubitably a possession of an ancient time; but, while day by day the books of Egyptian and Assyrian history become more and more revealed to our research, little progress has yet been made in tracing that of Etruria. We have already alluded to some important examples of their toreutic workmanship yielded to us by her tombs, for from their contents, almost exclusively, do we learn what little we know of their minor arts and the habits of their lives. These contents frequently offer parallel proof of the uses to which bronze was applied as described in the writings of Hesiod and Homer. Thus we find in the Perugian grottoes the beaten plates covered with figure subjects which once adorned a chariot, and some objects of furniture. The walls of tombs, as at Fonterotella, seem sometimes, from fragments of their metal which remained, to have been partly or in whole covered with an ornamental metallic lining. A tomb recently opened at Chiusi had the floor paved with strips of bronze fastened together by nails over crossed iron rods. These discoveries recall the description of the treasury of Atreus at Mycenæ, and declare that the blind bard was not in poetic flight dreaming merely of what he had never known. The abundant use of bronze for cast and beaten work by the Etruscans is very remarkable; and, although few of their larger works remain to us, the museums of Europe display a marvellous variety of votive statuettes, lamps, vessels, and instruments, furniture and armour, admirably formed, and in some instances inlaid with silver and gold in a manner which proves their equal skill with the Greeks in this mode of enrichment. Yet, notwithstanding the great excellence in point of skilful casting, beating, or inlaying, and the high finish bestowed by the Etruscans in their works in bronze, they never advanced in the higher walks of sculpture to within a long distance of that glorious perfection attained among the Greeks, by artists like Polycleitus or Lysippus. Etruscan cities, no less than those of Greece, were crowded with statues of the gods and heroes; and Rome in her aggrandisement by conquest derived her best adornment from the pillage first of Etruria and then of Greece. Some idea of the number of statues in the cities of Etruria may be gathered from the statement that at the capture of Volsinii by the Romans (B.C. 280), at least two thousand, some of which were of colossal size, were carried away to Rome; but whether all of bronze may be questioned.

Although we do not here pretend to inquire into or attempt to distinguish the bronze works of the other peoples of Italy, which, perhaps, less developed than by the Etruscans, were ably and abundantly produced by the Pelasgians and Tyrrhenians, the Samnites, the Volscians, and probably by the Sabines and other races, we must not lose sight of the fact that many such existed. Pliny informs us that the great bronze statue of Apollo in the Palatine, taken from the Samnites, was so large that when set up in Rome it was visible from the Alban hills. One of the most ancient of bronze statues was that of Jupiter, which stood near the temple of Minerva at Sparta. This was formed of beaten plates fastened together by nails, and was said to be the work of Clearchus of Rhegium, in the south of Italy; but whether he was a Pelasgian or a Greek we do not know. Among the few Etruscan bronzes of larger size which have been preserved, admirable in point of execution though partaking of the archaic and oriental character, is the remarkable figure of the Chimæra, inscribed in Etruscan characters TINSCVIL, now in the museum of the Uffizii at Florence. It was found at Arezzo in 1534. The Minerva, also found at Arezzo, is another and still earlier work in the same museum. The well-known bronze wolf of the Capitol, also an archaic work (although by some supposed to be a production of the middle ages), is ascribed to Etruscan artists, and presumed to be that of a votive figure erected in the year 295 B.C., at a time when Grecian sculpture was far advanced beyond its period of greatest excellence. A cast of this wolf in scagliola is in the South Kensington museum. An inscribed figure of a boy holding a goose is now in the Leyden museum; the lettering is executed in silver on the right leg and thigh. A larger and more advanced work (probably of the period of Roman rule in Etruria, but before her language had fallen into disuse) is the life-sized statue of the orator Aulus Metellus, found on the shores of Thrasymene, in 1573, and now in the Florentine museum.

(*To be continued.*)

HINTS TO REPAIRERS.

(Continued from page 35.)

WE concluded our last article with the promise of a description of a simple and practical staking tool. It can be made as follows :—

Take an old upright tool and fit a dozen small hollow stakes to it, each one with a different sized hole, so as to accommodate any sized pinion ; make the upper end perfectly flat and true, with a shoulder on the other end, each one of which should just fit into the hole in the plate of the tool, projecting above the plate about one-fourth of an inch ; cut off the end of one of the centres, or rather both ends, and drill a hole in one end of it, and bore it out slightly taper for about half an inch ; then make a dozen or more punches to fit into it, making a round end and flat end to one of each size, drilling holes in the ends to suit any sized pinion, then temper and polish all the punches and stakes, leaving them a light straw colour, also make two for staffs; drill a very small hole in the one for fine pivots and then chamfer the corners of the hole, and in the other drill a larger hole and chamfer in the same way. If it is necessary to drive out or in a pallet staff, for instance, put a stake in the hole in the plate that will freely admit the staff, lay the pallets on it with the large end of the staff down, select a punch that will admit the pivot but not the staff, (two sizes will do for all), put it in the old centre, which now answers for the handle to the punch, and then put it in the hole of the tool and bring it down on the pallets so that the pivot will enter, and a slight blow on the end will drive out the staff, and will never break or bend a pivot, neither will it in putting the staff into the pallets. This we have found to be a valuable tool.

For rivetting in the centre wheel, select a stake that will just freely admit the upper staff of the pinion, and place it on the plate ; select a round punch that will just pass over the shoulder of the lower pivot and put it in the piston ; place the pinion in the stake, lay the wheel on it and proceed to rivet it down, turning your punch at every stroke of the hammer. When firmly rivetted on, take out the round punch and put in a flat one, giving it a few taps. If the punches are well polished, the pinion will be but little disfigured, if at all, and very little polishing will bring it up right, if a fine watch, and if an ordinary one, no polishing will be required. With this tool a nice job can be done, and done quickly.

We have now done with the centre wheel, and, in accordance with our first idea, we shall continue on the "train" until we come to the escapement. If a new centre pinion is to be put in, select one with the right number of teeth first, then get the size from the old one with a pinion gauge, or, what is still better, use one of the Swiss dial gauges, which will give more accurate measurements ; and for a scape pinion, for instance, too much care cannot be exercised in selecting one of the proper dimensions.

Having selected a pinion, cement it up on the lathe, and true it up by the outside of the leaves ; when it is cold, make a good centre on the projecting end ; reverse it, and again true up by the outside of the leaves. If the old centres were very much "out of centre," you will have to again reverse it and true up by the outside of the leaves. The reason for this is, upon a little reflection, very manifest ; yet how few ever think of it, or take the trouble to get centres in this way. We have very frequently found, on putting a pinion up in the lathe and truing it up by its pivots, that the outside of the leaves were not concentric with the pivots ; and this, too, in watches that were not considered poor watches either.

If you have the old pinion for a guide, you can with but little trouble get your distance in the new one. We usually fit in the upper pivot, and get the body of the pinion the right length, and mark about where the centre wheel will come, then polish the staff portion of the pinion same as for the fuzee pivots. Now comes the terror of all inexperienced workmen who are anxious to do good work, but don't know how ; that is, to "face up" the pinion. It is a very easy and simple process, but can be done with a bow better than in the lathe. Clean the shellac all off from the pinion, and put in a screw collet. If you have no polishers, proceed to make some at once, as follows :—

Take a piece of sheet steel, say half or three-quarters of an inch square, make it slightly convex on one side by means of a large round-ended punch ; lay the piece of steel on a block of lead and hammer it or force it into shape with your punch ; drill a hole in the centre slightly larger than the staff part of the pinion, and with a flat file file the convex side just sufficient to make a flat place large enough to cover the ends of the leaves ; apply some oil-stone powder and oil on your polisher, insert your pinion staff (having put on the drill bow), hold the steel polisher or grinder rather loosely with the fingers of the left hand, and with the other end of the pinion in one of the holes of your vice work it back and forth just as if you were drilling a hole. As soon as the grinder sets smooth, file up again, always bearing in mind that the oil-stone powder only acts while the grinder is rough. As soon as you have got a good flat smooth surface on the end of the pinion, clean it off and use a polisher made of bell metal, just like the steel grinder, using not less than two grades of crocus ; then a copper polisher and very fine crocus will give a fine gloss. To get the "black" polish so much admired in fine work requires some little time, and the use of several grades of polishing stuff. Always clean off every particle of the last used powder before using a finer grade, otherwise you may have your work all to go over again, as one particle of coarser powder mixed with a finer grade will make a scratch that takes time to remove with a coarser grade than the one you are using when the scratch occurs.

Having finished up this end, put up in the lathe and fit on your wheel and turn and finish up the other. After having riveted in your centre wheel, as directed in a former article, polish up the "hollow" in this end of the pinion just in the same way as you "faced up" the other end, only you will require *convex* polishers and grinders. For this purpose you will find the steel and brass wire grinders and polishers the kind to use. The end can be finished up very nicely while in the lathe by the same process as that of polishing the "hollow" of the fuzee.

Whenever you put in a new pinion and are going to use the same old centre wheel, see if the teeth are worn much. If so, put it in the other side up when you put it in again, and always, whether you reverse it or not, put it up in the lathe, truing it up by the outside of the teeth, and then true out the hole, as no watch can perform satisfactorily unless the outer extremity of the teeth of wheels and leaves of pinions are concentric with the pivots. Too little attention is paid to this by the majority of workmen. Some will say, what is the use of all this work in the face of a pinion, as the owner never sees it, and no action takes place there ? Now all will admit that it certainly looks better, which is one reason ; next, all ought to know, if they don't, that dirt and dust will not accumulate and stick to a piece of finely polished steel as it will to that which is rough, which is another good reason ; and furthermore, if you will only take the pains and trouble to face up your pinion properly, you will be very certain to do the rest of the work properly, which is a very important reason. These are three good reasons for facing up a pinion, and not one good reason can be given why it should not be done.

(To be continued.)

CURIOSITIES OF CLOCKS AND WATCHES.

(*Continued from page* 33.)

In order to tell the time in the night after the sun was set, there was an hour hand placed directly opposite to the sun, also a minute and second hand, all in one centre, so that the time of the day or night might be as easily known by this as by any other clock. There were two other hands in this centre, one called the moon's nodes, which showed the time of the eclipses; and the other the equation of time, or the difference between the sun and the clocks. There were also two lesser horizons within those of the sun, to regulate the rising and setting of the moon, in the same manner as those of the sun. The moon showed the time of new and full, her increase and decrease, always representing the same figure as it really was in the heavens.

The Copernican system was composed of seventeen bodies, in the centre of which was placed the sun, showing its rotation, and the planets moving round it, in the same signs of the zodiac as they were in reality. Their orbits had all due inclinations, and lay in their true plains. Underneath were folding doors, which on being opened discovered four other systems, in which the motions of the planets were more clearly described. The first was the polar system; the second, the system of Jupiter and his moons; the third, the eclipses of the sun and moon; and the fourth, the earth's annual motion. Another piece of mechanism represented the course of the comet of 1759. Below these was the representation of a landscape and the sea. On the former, vehicles, persons, and animals were seen in motion; and in the latter, ships were sailing. Another scene displayed a carpenters' yard, with men at work. During the whole performance of the machine, when upwards of 1,200 wheels and pinions moved all together, it played several pieces of music on an organ, which likewise was provided with keys, so that any piece might be played upon it.

Alexander Cumming, F.R.S., an ingenious mathematician and mechanic, a native of Edinburgh, who died in 1814, made a clock for George III., which registered the height of the barometer during every day throughout the year. This was effected by a circular card, of about two feet in diameter, being made to turn once in a year. The card was divided by radii lines into 365 divisions, the months and days being marked round the edge, while the usual range of the barometer was indicated in inches and tenths by circular lines described from the centre. A pencil, with a fine point pressed in the card by a spring, and held by an upright rod floating in the mercury, accurately marked the state of the barometer; the card being carried forward by the clock, brought each day to the pencil. It was not even necessary to change the card at the year's end, as a pencil with a different coloured lead would make a distinction between two years. This barometer-clock cost nearly £2,000, and the maker was allowed a salary of £200 per annum to keep it in repair. Cumming, in 1766, published "The Elements of Clock and Watch-work, adapted to practice." The following is a copy of the original advertisement of this work :—"This day is published, in one volume, in quarto, price 15s., in boards, 'The Elements of Clock and Watch-work, adapted to practice;' in two essays. By Alexander Cumming, Member of the Philosophical Society, Edinburgh. Printed for T. Cadell (successor to Mr. Millar), and D. Wilson and G. Nicol, in the Strand; and Fletcher and Anderson, in St. Paul's Churchyard."

Sir Christopher Wren proposed to have a clock constructed on a similar principle to that of Cumming's barometer-clock, in order to register the position and force of the wind. This idea has been of late years adopted. At Greenwich Observatory is a contrivance for registering the force and direction of the wind. It was thus described in *Household Words* for 1850 :—"The wind turns a weathercock, and by aid of cog-wheels, the motion is transferred to a lead pencil fixed over a sheet of paper, and thus the wind is made to write down the direction which itself is blowing. Not far distant is a piece of metal, the flat side of which is ever turned by the weathercock to meet the full force of the wind, which, blowing upon it, drives it back against a spring. To this spring is affixed a chain passing over pulleys towards another pencil, fixed above a sheet of paper, and moving faithfully, more or less, as the wind blows harder or softer. And thus the gentle zephyr, and the fresh breeze, and the heavy gale, and, when it comes, the furious hurricane, are made to note down their character and force. The sheets of paper on which the uncertain element, the wind, is bearing witness against itself, is fixed upon a frame moved by clock-work. Steady as the progress of time, this ingenious mechanism draws the paper under the suspended pencils. Thus each minute and each hour has its written record, without human help and inspection. Once a day only, an assistant comes to put a new blank sheet in the place of that which has been covered by the moving pencils, and the latter is taken away to be bound up in a volume."

Babbage, in his "Economy of Manufactures, 1835," says: —"Another purpose to which machinery for registering operations is applied with much advantage, is the determination of the average effect of natural or artificial agents. The mean height of the barometer, for example, is ascertained by noting its height at a certain number of intervals during the twenty-four hours. The more these intervals are contracted, the more correctly will the mean be ascertained; but the true mean ought to be influenced by each momentary change which has occurred. Clocks have been proposed and made with this object, by which a sheet of paper is moved, slowly and uniformly, before a pencil fixed to a float upon the surface of the mercury in the cup of the barometer. Sir David Brewster proposed, several years ago, to suspend a barometer, and swing it as a pendulum. The variations of the atmosphere would thus alter the centre of oscillation, and the comparison of such an instrument with a good clock would enable us to ascertain the mean altitude of the barometer during any interval of the observer's absence. About seven or eight years since, without being aware of Sir David Brewster's proposal, I adapted a barometer as a pendulum to the works of a common eight-day clock; it remained in my library for several months, but I have mislaid the observations which were made." In 1837, Jurgensen, a celebrated watchmaker of Copenhagen, invented a clock which, at the end of every twenty-four hours, indicated the average temperature of the preceding day.

We learn from the *Gentlemen's Magazine*, and the *Annual Register*, for 1766, that in that year two curious clocks of small size and great beauty were presented by the East India Company to the Emperor of China. These clocks were in the form of chariots. In each of these chariots was the figure of a lady seated, with her right hand leaning on part of the vehicle, underneath which was a striking eight-day clock, not larger than a shilling. Upon the lady's finger sat a bird, set with diamonds and rubies, with its wings expanded, which were made to flutter for some time by touching a diamond button below it. The body of the bird that contained the mechanism by which this was effected, was not larger than the sixteenth of an inch. The lady held in her left hand a gold tube of the thickness of a large pin, in the top of which was a small round box, to which a circular ornament set with diamonds, not larger than a sixpence, was fixed. Over the lady's head, supported by a small fluted pillar, no bigger than a quill, was a double umbrella, under the largest of which a bell was fixed at a considerable distance from the clock, but having a hidden communication with it, by which a hammer was made regularly to strike the hour, and to repeat the same at pleasure by touching a diamond button underneath the clock. At the feet of the lady was a gold dog, before which, from the point of the chariot, were two birds, fixed on spiral springs, their wings and feathers being set with coloured stones; and they appeared as if they were flying from the vehicle. By a secret motion the chariot could be moved in any direction; a boy behind it appearing to push it forward. This exquisite piece of art and workmanship was made entirely of gold, superbly embellished with diamonds, rubies, pearls, and other precious stones.

(*To be continued.*)

QUERIES AND ANSWERS.

M. G. B.—1. *Whitening Silver.*—Mr. George E. Gee, in his "Silversmith's Handbook," describes a process which we have found very practical and successful:—"A mixture of very dilute sulphuric acid is first provided, in the proportion of one ounce to forty ounces of water, and well mixed together; the work, after being heated to a good red-heat, is boiled in this, which soon removes the oxide from the surface, and shows the fine white colour of the pure silver. For fine silver work, such as Indian filigree, one process will generally suffice, for English standard quality two, and for low qualities three, but these latter must not by any means be too low; if so, no colouring can take place by this method. Common articles of silver cannot be whitened by annealing and boiling out in a diluted acid; a thin film of pure silver must be deposited upon their surface by electro deposition, or by the action of some chemical preparation in which fine silver forms the principal ingredient." There are a number of other whitening methods; but the above one we can recommend from personal experience as both simple and effective.

2. *Test for Silver and Gold.*—A number of useful tests and hints for the detection of spurious gold and silver have been given in previous issues of this Journal. You will find the following simple, sure, and expedient:—Dissolve bichromate of potassa in water, and add a little sulphuric acid. The solution will have a blood-red appearance. Scratch the object with the stone and apply the solution; if silver, a red sediment will remain; but if base metal, the coated parts will disappear or turn yellow. The testing stone must be well cleaned after using.

The ordinary method of testing gold by the touchstone is founded upon the insolubility of this metal in nitric acid. If a mark be made in the touchstone with the article under examination, the gold is not dissolved by this acid, whereas golden-coloured alloys of inferior value are dissolved and disappear immediately. When articles are very thinly gilded, the detection of the gold in this manner is uncertain, but the following test fluid can be applied with advantage:—A little carbonate of copper is put into a test tube, and to this is added, drop by drop, pure hydrochloric acid till the blue powder has dissolved to a clear green fluid, occasionally warming it over a spirit lamp. This concentrated solution of chloride of copper is diluted for use with from ten to eleven times its volume of distilled water. To afford a thorough test the surface of the article should be cleaned by brushing it for a minute or two with a little spirits of wine. A little of the testing fluid is then dropped in and allowed to remain in contact for about a minute. The fluid is then removed by means of a small pipette, and the surface of the metal completely dried with bibulous paper; if no dark spot be then visible, the article is coated with pure gold. If the metallic surface is but lightly gilded, a very slight blackening is sometimes remarked, which may throw a doubt upon the result. In such a case, to make quite certain, a little of the surface may be scraped off, and then the testing fluid again applied. If a dark spot is then perceived, the article may be considered as very thinly gilded.

Sham Hallmarks.—We are quite aware of the fraud you speak of, and the practice is certainly most injurious to legitimate traders and the public. The remedy you suggest would, however, not cure this evil; the compulsory hallmarking of *all* watch-cases would not in the least lessen the forgery of such marks. The only way to check these fraudulent practices would be for the trade to combine and rigorously prosecute such pests. Those fellows, who try to induce unwary holders of £2 6s. licenses to sell gold plate over two ounces, and silver plate over thirty ounces, and then prosecute them, might be more profitably employed in finding out such rascals as you point out and those that have no licenses at all.

A Subscriber.—Colouring Brass: You will find 1 oz. of rock alum per pint of water to give brass ornaments, not gilt or lacquered, a colour of the brilliancy of gold; add about the same quantity of diluted muriatic acid. The latter can be dispensed with if the articles are polished with tripoli after immersion in the alum solution. The colouring by this process we found, however, not very durable, and if you want to make a good job we should recommend the following method:—1½ oz. hyposulphite of soda in 1 pound of water, and add 1½ oz. acetate of lead dissolved in ½ pound of water, When this clear solution is heated to 190° to 210° Fahr., it decomposes slowly, and precipitates sulphide of lead in brown flocks. If metal is now immersed in it, a part of the sulphide of lead is deposited thereon, and according to the length of time and consequent thickness of the deposited sulphide of lead, the most beautiful lustres are produced. Brass articles will take in five minutes a colour varying from a beautiful gold to a copper red. The coating is very durable if the articles have been properly cleansed previously and are evenly heated.

SCHOOL FOR JEWELLERS.

In 1877, a school for the training of gold and silver workers was established at Pforzheim, the centre of the German jewellery trade, we are glad to hear that the undertaking has proved successful. Every branch of the trade, from designing to finishing, is thoroughly taught in three courses under the supervision of Dr. Waag, whose high artistic taste and great practical experience as a jeweller are well-known in his country, well supported by an equally well qualified instructor. Great care is bestowed on the selection of worthy models. Pupils must not be under 16 years of age, and must possess a certain knowledge of drawing and modelling in addition to the usual acquirements. Pecuniary assistance is provided for specially gifted youths. Last year's attendance was fifty-three.

The Roman Catholics of Sydney have decided to present Cardinal Newman, in commemoration of his being raised to the Cardinalate, a handsome gold salver, weighing fifty-four ounces.

Herr Fritz Bähni, of Bienne, well known to watch material dealers as a manufacturer of first-class watch-springs, died on the 23rd of August last, at the early age of thirty-eight.

MESSRS. CHRISTOFLE & CO.'S PLATING WORKS, IN PARIS.

THE precious metals being rare, says a sententious French writer, money and ornament speedily absorb them; but in all forms, they remain an unalterable value. And it is this unalterable quality which distinguishes them from other materials, even more brilliant in appearance, than themselves. Red copper, perfectly scoured, is more splendid than gold, and steel, at its highest polish, more superb than silver. But both steel and copper may rust or blacken, and be disfigured and worthless for ever, by the action of the elements; but for gold and silver there is, secularly speaking, no decay. The famous Christofle factory commenced with simple gilding on wood, leather, cardboard, and paper, and went on, through long and elaborate processes of metallurgy, until the founders of the works began to bethink themselves of the paths laid out by their predecessors, and to believe that the Cellinis might have their representatives yet in modern days. Much experience, no doubt, was gained from the records of the voltaic battery, and the innumerable experiments arising from it; yet the Christofle enterprise carries this industry above all former heights. The firm paid, for apparent violations of patent, millions (in francs) here, and millions there; it fought through long legal battles for rights and patents; it gained medals from exhibitions beyond counting; but it never succeeded in disproving the initiatory rights of the English inventors. So far then, the Christofle factory must be regarded as a successful adaptation, and no more,—flourishing upon expired English patents, but deserving of all possible credit on account of the spirit with which it has developed the ideas of their originators. The importance of this industry may be suggested by a simple parallel. Supposing the Christofle works to have been executed in solid metal, they must have withdrawn two hundred millions sterling from the National currency; as it is, they have utilised, year by year, about seven millions in value of the precious metals only. This, however, is a remark merely by the way. We have nothing to do, after all, with the economy of the subject,—simply with its mechanical facts. But to begin with, let it be understood that we have to consider a process which annually covers, upon gold and silver, a superficies equal to many thousand square acres, as they are measured upon this earth,—many thousand acres in fact, of superficial silver and gold. The first necessity, of course, is to get rid of rust; then to do away with oil or grease, in whatever form and to whatever extent it may adhere; next to produce a perfectly uniform surface; lastly to determine upon the different methods to be adopted, with regard to either bronze or its kindred compounds; for not only have different metals or compounds to be treated in different ways, but their various temperaments, as it were, have to be considered. Thus bronze in its several stages, must be regarded as a number of distinct substances, and so with brasswork, through all stages up to the perfection at which it can be improved by no gold or silver plating whatever. Assuming, however, that the essential processes must be gone through, after the rust has been got rid of, there is a sort of earth or turf furnace, through which the metal, in the highest state of fusion, is passed; then its collection and percussion beneath the blows of a hammer, which beats the whole of the broken fragments into a fabric; afterwards the formation of another crust or rest of black copper, dispelled by a bath of sulphuric acid, diluted with water; and then, after a series of chemical baths, the metal is prepared for the Rosicrucian legerdemain. The Messrs. Christofle avow that they rarely turn out from their works a set of solid, or even half-solid, gold or silver. When they profess to do it, it is of course done, but the demand is not great for this kind of luxury, "in the solid," though as we are assured, the saving is far less than might generally be imagined between the substantial and the imitated work of art, the latter more meritorious, often, than the former, for they require the most minute watchings of temperature in the furnace, of weight after coming out of it, of calculation as to what is true and what is meretricious material, of facings and brightenings from almost invisible and incalculable quantities. It would be impossible, without an almost inexplicable —by figures or descriptions,—account of processes, or without artistic illustrations of the works, to reach, before the reader's eye, the stage at which the work takes practical shape in the sight of ordinary intelligence. The gold, or silver, has now been solved into a state resembling porcelain biscuit, capable of any polish or finish that may be desired. The moulds are ready. The metals may be plunged into them, and shaped into any form, whether of statues, dinner table centres, chimney ornaments, clock-cases, or those thousand and one shapes in which "gummed gilt," holds a position. Even now, however, the prime work of the Compagnie Christofle has not been brought to an end. It has to be scrubbed by metallic brushes, revolving at the rate of five hundred turns a minute, and wetted with mucilaginous water; every particle has to come up in its turn, and be accurately touched; and this part of the work is carefully followed by nimble-handed girls, experienced at their task, whose steel instruments make up, as a rule, for whatever is deficient in the larger machinery. These girls, it may be stated, are selected for their work with the utmost care, so delicate and elaborate are the tasks imposed upon them, though their earnings rarely average beyond half a crown or three shillings a day. They are incapable, in fact, of performing the labour required from men—of hammering down gold and silver surfaces into the forms which will be required by the artist, as his models and designs in the rough; of beating heavy masses into hollow patterns, between metal and parchment; of distributing a mass of metal in the manner which gives a result of luxury. The Messrs. Christofle, however, understand their business, and employ men, women and girls accordingly. Their art is now chiefly directed to the reproduction, through gilding and silvering processes, of fine art objects, wrought by the chisel; of decorative furniture and imitative statuary; and, especially, of all such objects of art, beauty, and splendour as might properly be represented by masses of solid silver or gold. They employ, to this end, an alloy of a combination peculiarly their own, or, rather, two combinations, both composed of copper and zinc, though in different proportions, the first used, so to speak in the foundation forms, the second in the outward or auxiliary decorations; these latter being, more or less, sculptured with tools of steel. The originals, however, in each instance, must be modelled in moulds of plaster or of wax, passing through, afterwards, repetition moulds in sand and crucibles of fire-brick or clay; and, even after these tests have been gone through, the great ordeal is to come,—the working out of the pattern by the engraver, or by his slaves, who have sunk a pattern in steel, or else in galvanoplating. At this stage, the process, whatever the principle adopted, becomes extremely interesting. It sets steam-hammers at work; it puts endless bands revolving; it draws and carves patterns upon otherwise insensate surfaces; it treats gold and silver as though they were gauze and thread, and stamps and weaves them into the imitations of Middle-age antiquity. The alloy engaged, even where electroplating does not come into question, is of a peculiar kind, according to what is actually adopted as the Christofle tariff, —copper, zinc, and nickel,—the last being valued as giving to the entire compound a more perfect whiteness and a greater durability. It may afford some idea of the industry thus kept going, to say that twelve furnaces are constantly at work; that a thousand hundred-weight of the "fac-simile metal" are brought under the steam-hammer every day, that miles upon miles of the glistening surfaces are prepared within the space of every twenty-four hours,—for this is a silent as it is an unrelaxing industry,—and that, in an ordinary way, the workmen of MM. Christofle can turn you out, for the most brilliant uses of Parisian dinner-tables, family plate at the rate of a dish cover a minute,—sufficient, assuredly, to conceal the sins of many cooks. But the dish-cover, when it comes out of the machine, is a flat piece of metal; it has to be tortured into an oval, or circular or other shape; yet leaving that alone, we are brought face to face with the statistics of this gigantic manufactory for one year :—300,000 dish-covers, 35,000 dessert covers, 550,000 coffee-spoons, and 90,000 dessert-knives, and, as the statement confesses, "a whole rubric of little goldsmiths' work" for sugar basins, sauce-boats, fruit services, and so forth. Well, the Christofle establishment employs about 1,500 hands,—nearly all skilled, —and pays about six millions of francs a year in salaries and wages, not a single franc of which, we may rest assured, is thrown away. Recently, too, it has brought within the scope of its operations the application of aluminium, allied with copper, to objects of art, and the success of the experiments in this direction has been more than satisfying to those by whom they were originated. There has been a long struggle between the French and the English with respect to gold, bronze, electro-plate, and other mixed work, relatively to the art industry, and the industrial art, now common objects of ambition to both nations; and it must be matter of hope, on each side, whichever put a foot forward in advance, that the true principle shall take the lead; so that we welcome these reports from the Christofle factories, whether of gold and silver in their purity, or in their mellowed adaptations to the necessities and customs of the time, as pointing to prizes within reach, and well worth winning when won.

TRADE RECIPES, &c.

Bronze Paint for Iron or Brass.—Take chrome green, 2 lbs. ; ivory black, 1 oz. ; chrome yellow, 1 oz. ; good japan, 1 gill ; grind all together and mix with linseed oil.

Expansion of Wrought Iron and Cast Steel.—It is important in workshop manipulation to remember that if a piece of cast steel be made red hot and quenched in cold water it will become longer, but if the same operation be performed upon a piece of wrought iron it will become shorter.

Varnish for Gilt Articles.—Gumlac, 125 parts ; gamboge, 125 ; dragon's blood, 125 ; annatto, 125 ; saffron, 32. Dissolve each resin in 1,000 parts by measure, of absolute alcohol; two separate mixtures must be made with the dragon's blood and annatto, in 1,000 parts of such alcohol ; and a proper proportion of each should be added with the gamboge to the varnish, according to the shade of colour required.

Holes in Hard Steel may be made with nitric acid. To apply it, cover the steel plate at the place where you wish the hole with a thick layer of melted wax ; when cold, make a hole in the wax of the size you want the hole in the plate, then put on one or more drops of strong nitric acid, leave it on for some time, wash off the wax, and if not eaten through, apply other drops of the same liquid, and continue this until the plate is perforated.—*Ironmonger*.

Gold-Lettering on Glass.—The size is prepared by dissolving one ounce of isinglass in just enough water to cover it; when dissolved, add a pint of rectified wine spirit and make up to a quart with water. Give the clean glass a flowing coat of this, and carefully lay on the leaf, which will then readily adhere to the glass. Let it remain twenty-four hours to dry. The design or letter is drawn on paper, and the lines pricked with needle holes. Place this against the gilded surface, and dust it thoroughly with powdered whiting. When the paper is removed there will remain a correct copy of the design or letter on the gold. Now fill up the outline with oil gold size in which has been ground some orange chrome, thinned somewhat with boiled oil and turpentine. When this has thoroughly dried, wash off the surplus gold with water and a piece of cotton wool.

Varnish for Polished Metal.—Take bleached shellac, pounded in a mortar; place the bruised fragments into a bottle of alcohol until some shellac remains undissolved ; agitate the bottle and contents frequently, and let the whole stand till clear ; pour off the clear fluid. This forms the varnish. Warm the metal surface, and coat with a camel-hair brush. If not perfectly transparent, warm the varnish surface before a fire or in an oven until it becomes clear. Common orange shellac answers equally well, and for large surfaces even better, as it is more soluble than the bleached variety, and coats more perfectly, but care must be taken not to use the varnish insufficiently diluted. Another varnish is prepared as follows :—Digest 1 part of bruised copal in 2 parts of absolute alcohol ; but as this varnish dries too quickly, it is preferable to take 1 part of copal, 1 part of oil of rosemary, and 2 or 3 parts of absolute alcohol. This gives a clear varnish as limpid as water. It should be applied hot, and when dry it will be found hard and durable. Another preparation consists of Canada balsam mixed with an equal quantity of very clear spirits of turpentine, until the whole is of the consistency of ordinary varnish, which can be determined by constantly shaking and allowing to settle. This may be applied without warming the varnish or the metal.

Simple Construction of a Daniell Cell.—Select a small round earthenware jar, such as is used for keeping preserves, and having lined the bottom with gutta-percha, or some suitable cement, to the depth of a quarter of an inch, fix upright in this a rod of zinc, of equal height with the jar, to which a length of copper wire has been attached by passing it through a hole drilled in the upper part of the zinc rod, or by soldering. Make a cylinder of pipe-clay, or other porous clay, larger than the zinc rod, and having dried it, make it hot in the fire by degrees, till it attains a red heat. Let this cylinder cool gently, and when cold place it in the jar round the centre rod, encircling it at a little distance. By moderately heating the end of the cylinder it will, when placed on the gutta-percha, make a groove which will fix the tube, and prevent infiltration of the fluids. Line the inside of the jar with a plate of thin copper bent into cylindrical form, and having a few holes punched in it, through which may be threaded the extremity of another length of copper-wire. On the top of this cylinder place a flat ring of copper pierced with holes, and nearly, but not quite, touching the porous cylinder. This forms the battery. To charge it, the *Electrician* gives a saturated solution of sulphate of copper poured between the copper and the clay tube, and some crystals of the same salt are placed upon the perforated ring so as just to be in contact with the solution. The zinc compartment is then to be filled with a solution of sulphate of zinc, sal ammoniac, or common salt.—*Scientific American*.

(*To be continued.*)

A jeweller named Bonin, of Barcelona, Spain, has been robbed of £60,000 worth of diamonds; it is reported that the thief has been arrested at Marseilles.

In consequence of the number of diamonds discovered in the Echunga district (South Australia), a deputation waited upon the Commissioner of Lands, asking the Government to set aside £1,000 for prosecuting a search for diamonds there, to which proposal the Commissioner was favourably inclined, and he promised to see his colleagues on the subject. Subsequently it was resolved to attempt to float a diamond prospecting company.

THE

Watchmaker, Jeweller, & Silversmith,

A MONTHLY TRADE JOURNAL,

Devoted to the interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades; published at Milner's Buildings, Moorgate Street (Opposite Moorgate Street Station), London, E.C. Booksellers and Newsagents supplied by Messrs. Catty & Co., 12, Ave Maria Lane, Paternoster Row, E.C.

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All Remittances should be made by Post-office Orders.

Remittances by Cash or Stamps are entirely at the Sender's risk, and very objectionable.

Mr. J. H. Johns is the only authorised traveller for this Journal.

Receipts for subscriptions will only be sent when asked for, and on receipt of postage stamp for such purpose.

PATENTS.

United States of America.

216,031. Le Roy W. Fairchild, of New York, N.Y., for "A combined pencil and watch-key."—Application filed 20th February, 1879.

216,101. August Oppenheimer, of New York, N.Y., assignor to Oppenheimer, Brothers, and Veith, of the same place for "Neck-chain slides."—Application filed 24th April, 1879.

216,215. George B. Owen, of Winstead, Conn., for "Lock-works for clock-movements."—Application filed 13th December, 1878.

216,586. Adolph Vester, of Providence, R.I., for "Plated jewelry."—Application filed 7th September, 1878.

216,814. Benjamin Wormelle, of Brighton, Mass., for "Watch-winding devices."—Application filed 28th June, 1878.

216,917. William A. Wales, of Auburndale, assignor to William B. Fowle, of Newton, Mass., for "Blanks for watch and clock dials."—Application filed 1st November, 1878.

216,954. Louis Heckmann, of Wrentham, Mass., assignor of two-thirds of his right to William H. Wade and Edward P. Davis, of the same place, for "Ear-rings."—Application filed 1st May, 1879.

216,955. Anthony Hessels, of New York, N.Y., for "Machines for cutting diamonds."—Application filed 5th April, 1879.

217,061. Robert T. Chapman, of Louisville, Ky., for "Bracelets."—Application filed 1st May, 1879.

217,092. William E. Greene, of Providence, R.I., for "Ear-rings."—Application filed 2nd December, 1878.

217,291. François Lambert, of Ansonia, Conn., for "Watch and clock pinions."—Application filed 28th April, 1879.

217,326. Victorien Bousset, of Morez-du-Jura, France, for "Escapements for watches."—Application filed 28th September, 1878.

217,398. John S. Palmer, of Providence, R. I., for "Manufacture of stock-plate for jewellery."—Application filed 23rd November, 1878.

217,419. Jacob A. Smith, of Salem, Ohio, assignor of one-half of his right to Charles F. Kesselmire, for "Safety center-pinions for watches."—Application filed 6th May, 1879.

217,453. Charles Downs, of Providence, R. I., for "Stock for bracelets, &c."—Application filed 12th June, 1879.

217,522. George B. Fittz, John Baxter, and Mark E. Rowe, of Attleborough, Mass., for "Jewellers' frosting-tools."—Application filed 27th March, 1879.

217,620. Friedrich Imhæuser, of Brooklyn, N.Y., for "Watchmen's Time-detectors."—Application filed 27th November, 1878.

Patents granted in British Colonies and Dependencies.

Canada.

10,017. Ezra C. Fitch, of New York, U.S., for "Improvements in watch cases."—5 years—Dated 28th May, 1879.

10,135. Henry H. Ham, Jr., and Elbridge G. Pierce, Jr., of Portsmouth, N.H., U.S., for "Improvements on Marine clocks."—5 years—Dated 23rd June, 1879.

10,210. J. W. Holmes, of Wheatville, N. Y., U.S.A., for "A sun dial or solar chronometers."—Dated 9th July, 1879.

10,210. Joseph W. Holmes, of Wheatville, N.Y., U.S., for "Improvements on sun dials."—5 years—Dated 9th July, 1879.

Patent on which the Stamp Duty of £50 has been paid.

3487. Emma Elizabeth Ashing, of Camden Town, in the county of Middlesex, for an invention of "Improvements in solitaires and studs, and other similar dress fastenings."—Dated 5th September, 1876.

Patent which has become Void.

3616. William Henry Douglas, of Stourbridge, in the county of Worcester, Jeweller, for an invention of "Improvements in studs or clasps."—Dated 15th September, 1876.

Patents Sealed.

933. Etienne Mathurin Léon Maxant, of the city of Paris, in the republic of France, for an invention of "Improvements in invisible clock-winding mechanism with permanently located keys."—Dated 10th March, 1879.

2795. Henry Port, of Small Heath, near Birmingham, and Theophilus Varley, of Walthamstow, in the county of Essex, for an invention of "Improvements in electric and other time pieces and in apparatus connected therewith."—Dated 9th July, 1879.

Notices to Proceed.

1871. Edward Griffith Brewer, of 33, Chancery Lane, London, has given notice in respect of the invention of "Improvements in the construction of button studs, solitaire studs, and other like fastenings."—A communication to him from abroad by Louis Andre Lion, of Paris, France.

2989. John Price Hunt, of Birmingham, in the county of Warwick, Jeweller, has given notice in respect of the invention of "Improvements in or relating to ear-rings, ear-studs, necklets, chains, and bracelets, applicable to other ornamental and useful articles or appendages."

Patents Granted in Foreign States.

German Empire.

7188. R. Thiede, of Waldenburg, for "A many years clock."—Dated 4th March, 1879.—Class 83.

7191. W. Lindon, of Brooklyn, for "A striking-work for clocks."—Dated 15th March, 1879.—Class 83.

7360. L. Wenning, of Munich, for "A remontoir for musical boxes."—Dated 24th September, 1878.—Class 83.

Applications for Letters Patent.

3592. John Bettridge Hill, of Birmingham, in the county of Warwick, Jeweller, for an invention of "Improvements in fastenings for bracelets, chains, scarf slides, and other articles of jewellery, applicable also as a fastening for card cases, purses, and other similar articles."—Dated 6th September, 1879.

3593. Charles Feis, of Bartlett's Buildings, in the city of London, Watch Manufacturer and Importer, for an invention of "Improvements in watches."—A communication to him from abroad by Messieurs August Vuille and Fils, of Chaux-de-Fonds, in Switzerland, Watch Manufacturers.—Dated 6th September, 1879.

3680. Hubert Airy, M.D., of Kidbrook Grove, Blackheath, in the county of Kent, for an invention of "Improvements in self-recording thermometers."—Dated 15th September, 1879.

3707. William Parsons, of Birmingham, in the county of Warwick, Jeweller, and Henry Allen, of Birmingham aforesaid, Die sinker, for an invention of "A new or improved earring lock and fastener."—Dated 16th September, 1879.

3760. Walter Bentley Woodbury, of South Norwood, in the county of Surrey, for an invention of "Improvements in means for and methods for producing designs upon metallic surfaces."—Dated 19th September, 1879.

3863. Auguste Lion, of Paris, in the Republic of France, Jeweller, for an invention of "Improvements in articles of jewellery having a scale-like appearance, and in the manufacture thereof, specially applicable to bracelets, necklaces, chains, and other such like articles."—Dated 25th September, 1879.

Grant of Provisional Protection for Six Months.

3592. To John Bettridge Hill, of Birmingham, in the county of Warwick, Jeweller, for the invention of "Improvements in fastenings for bracelets, chains, scarf slides, and other articles of jewellery, applicable also as a fastening for card cases, purses, and other similar articles.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Blackburn, George, Whitehaven, watchmaker. Aug. 28. J. L. Paitson, sol., Whitehaven.

Canadine, William, Parkgate, Yorkshire, watchmaker. Aug. 27. A. S. Badger, sol., Rotherham.

Harmston, George, Lincoln, Watchmaker. Aug. 26. W. T. Page, sol., Lincoln.

Harrington, Walter Mickleham, Lowfield Street, Dartford, watchmaker. Aug. 27. W. Bussell, sol., 123, Chancery-ln.

Lombardini, Francis Napolean Bernardo, Exeter, late Newton Abbot, watchmaker. Aug. 30. At the Craven Hotel, Craven Street, Strand, London, in lieu of the place originally named.

Stagg, Leonard, Bridport, watchmaker. Aug. 28. H. Lock and Son's, sols., Dorchester.

Barrett, Robert, 51, Berwick Street, Oxford Street, and 110, Cornwall Road, Notting Hill, jeweller. Sept. 4. At Marshall and Clark's, 4, Portugal Street, Lincoln's Inn.

Blyth, Thomas, London Road, Leicester, jeweller. Sept. 1. Loseby & Co., sols., Leicester.

Moore, Charles Halse, Grange Inn, Birkenhead, jeweller. Sept. 2. Hannan & Pugh, sols., Birkenhead.

Shirtcliff, William Richmond, Cross Rockingham Lane, and Kearsley Road, both Sheffield, silver plate manufacturer. Sept. 3. W. Crouther, sol., Sheffield.

Talbot, Richard, Westgate, Wakefield, jeweller. Sept. 4. T. Burton, sol., Wakefield.

Banton, Richard, and Hubert Curtis Banton, trading as R. Banton & Son, Spencer Street, Birmingham, goldsmiths and jewellers. Sept. 6. J. Jelf, sol.

Banton, Hubert Curtis, Spencer Street, Birmingham, and Villa Road, Handsworth, goldsmith and jeweller (separate creditors). Sept. 6. J. Jelf, sol.

Banton, Richard, Spencer Street, Birmingham, and Claremont Road, Handsworth, goldsmith and jeweller (separate creditors). Sept. 6. J. Jelf, sol.

Cohen, Charles, Vicar Lane, Hull, jeweller and dealer in watch materials. Sept. 6. F. Summers, sol., Hull.

Myers, George, Priestgate, Darlington, watchmaker. Sept. 12. W. R. Wooler, sol., Darlington.

Brice, Francis Henry, Monckton Hill, and Chippenham, jeweller, Sept. 16. At Plummer & Parry's, sols., Bristol, Oct. 6 at 2.

Harper, Alex., Burton-on-Trent, jeweller. Sept. 17. G. Bright, sol., Burton-on-Trent.

Heron, Christopher, Morpeth, draper and jeweller. Sept. 20. At H. S. Bird's, sol., Newcastle, Oct. 9 at 2.

Kaminski, Simon, Wynn Street, Birmingham, dealer in jewellery and watch materials. Sept. 16.

Perkins, Robert Andre, Northampton Street, Birmingham, jeweller. Sept. 17. C. Fowke, sol., Ann Street, Birmingham.

Trustees Appointed.

Flower, Walter L. (Bkt.), Jermyn Street, and Merton, jeweller. Tr., R. Webb, 86, Newman Street, jeweller.

Harmston, George (Liq.), Lincoln, watchmaker. Tr., G. Jay, Lincoln, accountant, & I. Cohen, Birmingham.

Tondo, Giovanni, trading as G. Tondo & Co. (Liq.), Cornhill, watch importer. Tr., J. Seear, 23, Holborn Viaduct, accountant.

Whalley, William H. (Liq.), Blackburn, jeweller. Tr., W. F. Brown, Northampton Street, Birmingham, jeweller.

MORE SWINDLE IN THE WATCH TRADE.

A firm, styling itself as S. Davis and Co., 16, Farringdon Road, London, W.C., made use of the German press to advertise "the bankrupt stock of a large American watch manufactory," consisting of 20,000 silver and gold watches. We need hardly mention that the quotations were very tempting. These disposers of "bankrupt stocks" were no doubt encouraged by the success of that famous Parisian firm noticed in the columns of this journal some time ago, and they probably thought that there were still some "flats" in the Fatherland to be provided with timekeepers. Unfortunately, one of these advertisements dropped into the hands of the president of the German Watchmakers' Society, who caused inquiries to be made into the character and standing of Messrs. Davis and Co., No. 16, Farringdon Road. The great watch depot "turned out to be a *private* house," with not even a brass plate at the door to indicate it as the residence of this extensive concern. On inquiry it was ascertained that a man of the name of Davis lodges in the house, but he was not visible, although repeated calls were made. The advertisement was ultimately handed over to the police.

Deutsche Uhrmacher Zeitung,
ORGAN DES CENTRAL-VERBANDES DER DEUTSCHEN UHRMACHER.

Expedition; BERLIN, W. MARKGRAFENSTRASSE, No. 48.
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This popular German periodical appears fortnightly, and may be had, post paid, for 2s. per quarter, and 7s. per annum. Single Copies, 6d. Advertisements are charged at 3d. per four-parted line. The journal is noted for really practical and scientific articles, and abounds with information concerning the requirements in the Art and Trade of Watchmaking. The great circulation of the same amongst Watchmakers in all parts of Germany and German Watchmkers abroad, secures for advertisements the best possible effect. Orders for Subscriptions and Advertisments, at Original Prices, carried out for Great Britain and Colonies—H. Bush's Publisher's Agency, Hull, Yorkshire; and for the United States—H. Horend, 186, East Broadway, New York.

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GERMAN WATCHMAKERS' SOCIETY.

The "German United Watchmakers' Society" held its annual general meeting at Dresden on the 1st ult. From the report before us it appears that the society is progressing, and that its members' list has swollen from 700 in 1877 to 1,361 in 1879. Much useful work has been the result of these united efforts. The introduction of a uniform apprentice contract, examination of assistants, the issue of testimonials by a properly constituted and qualified body, and the foundation of a flourishing School of Horology at Glashutte, are measures which will not fail to bear good fruit. Much has also been done towards checking illegitimate trade. There is no doubt that many members of the trade have made great sacrifices in conforming honestly to all the rules this society prescribes, but their readiness to consider the general welfare of the trade has been recognised, and they will not be losers in the end. We are glad to notice this spirit of fellowship among German watchmakers, and could we only unite 1,361, or even half that number, of British ones, we should not be long in ridding ourselves of our trade grievances and trade pests. The German watchmaker has found out that his fellow craftsman *is not his enemy*, and that they have interests in common. Cannot the British watchmaker also see as far as that? Would it not be better for the trade to obtain by friendly co-operation what he is asking his paternal Government to do for him? Who is better qualified to legislate for the watchmaker than watchmakers themselves? If the watchmaker means to keep the watch and clock trade to himself let him look out, or else his customer will soon pass his door and buy his watch at the stationer's.

IMPORTANT SALE OF JEWELS.

The magnificent collection of jewels owned by the late Madame Musard has been disposed of by auction, at the Hotel Drouot, Paris. Most of the principal Parisian jewellers were present, and competed in quite a spirited manner for the possession of some of the leading lots. A necklace, consisting of 5 large diamonds, surrounded by a row of brilliants connected by a double row of bezels with clasp and hooks, and ornamented with a brilliant surrounded by a row of bezels, realised nearly £5,000 (124,500 francs). A pair of earrings brought over £2,000. A necklace of 475 pearls was sold for £6,800. The total of the first three days' sale was 1,078,910 francs.

One of the richest and rarest treasure chambers in the world is that belonging to the Sultans of Morocco, in the city of Fez. It was established there in 815 by the Sultan Edris ben Edris, the founder of the city, and it has been enriched by some addition to its valuables or rarities by almost every one of his successors. There are preserved in it many precious relics belonging to the time of the Moorish rule in Spain, and there is a sword of Ferdinand the Catholic, the handle of which is a mass of precious stones. It is needless to say that this treasure is most carefully guarded, and some travellers say that there are in it and about it nearly 2,000 locks. Some months ago the Sultan Sidi Muley Hassen, who has been long suffering from gout, confided the charge of the Fez treasury to his brother, Prince Muley Abbas, who, in his turn, intrusted it to the Governor of Fez. A few weeks ago the Sultan was presented by one of his vassals with a splendid revolver, which was adorned with gold and precious stones. His majesty ordered it to be lodged in the treasury, but, upon entering the chamber, some boxes were found broken open and completely emptied of their contents. The Sultan had several persons arrested, but the inquiry led to no result; and he has now offered a reward of 38,000 dols. for the discovery of the thieves.

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Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

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CONTENTS.

PAGE
Horology 55
British Horological Institute 56
Practical Instructions to Jewellers, Silversmiths and Electro-platers 57
Chalfont's Going Barrel and Stopwork .. 57
Bronzes 58
Trade Recipes, &c. 59
New Designs in Gold and Silver Jewellery 59
Curiosities of Clocks and Watches 60
Hints to Repairers 61
The Silver Trade and Hall-Marking Question 62
Technical Education 64
Correspondence 65
Patents 66
Monthly Record of Bankruptcies 67
Clocks and Optical Goods 68
Directory ii
Advertisements .. .. i-x

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HOROLOGY.

(*Continued from page* 42.)

XLVI.—Watch and Clock Hands.

THE hands of timekeepers are worthy of more attention than is frequently bestowed upon them by watch and clock makers. Their shape and general arrangement and the neatness of their execution is often taken by the general public as an index to the character of the entire mechanism that moves them; and some are apt to suppose that when care is not bestowed on the parts of the timepiece which are most seen, much care cannot be expected to have been exercised on the parts of the watch or clock which are invisible to the general view. Although we are not prepared to fully endorse the opinion that when the hands of timepieces are imperfect in their execution or in their general arrangement that all the mechanism must of necessity be imperfect also, still we think that in many instances there is room for improving the hands of timepieces, and we beg leave to direct a little more attention to this subject.

In the general arrangement of the hands of watches and clocks, distinctness of observation should be the great point aimed at, and everything that has a tendency to lead to confusion should be carefully avoided. Clocks that have a number of hands radiating from the centre, and moving round one circle—as, for instance, centre seconds, days of the month, equation of time, and hands for other purposes—may show a good deal of mechanical skill on the part of the designer and maker of the timepiece; but so many hands moving together around one circle, although they may be of different shades of colour, causes confusion, and requires considerable effort to make out what the different hands point to, and this confusion is frequently increased by the necessity for a counterpoise being attached to some of the hands. As a rule timekeepers should be so arranged that never more than the hour and minute hands should move from one centre on the dial. There may be special occasions when it is necessary or convenient to have centre seconds to watches; but these occasions are rare, and we are supposed to be talking about the hands of timekeepers in every-day use for the ordinary purposes of life, and also for scientific uses. In astronomical clocks we find the hour, minute, and seconds hands moving in separate circles on the same dial; and one reason for this arrangement is to prevent mistakes in reading the time. In chronometers, especially those measuring sidereal time, the hour hand is frequently suppressed, and the hours are indicated by a movable wheel or ring with figures engraved on it that show through a hole in the dial.

Hour and minute hands should be shaped so that the one can be easily distinguished from the other without any effort on the part of the observer. Probably a straight minute hand, a little swelled near the point, and a spade hour hand, are the shapes best adapted for this purpose, especially if the hands have to be looked at from a distance. There are occasions, however, when a spade hand cannot be used with propriety. In small watches, and clocks having ornamental cases, hands of other design are desirable, but whatever be the pattern used, or whatever hue of colour the hands may be made, it should ever be remembered that while a design in harmony with the case is perfectly admissible, the sole use of the hands is to mark the time distinctly and readily. The difference in the length of the hour and minute hands is also an important point in rendering the one easily distinguished from the other. The extreme point of the hour hand should extend so as to just cover the edge of the end of the chapter, and the extreme point of the minute hand should extend so as to cover about two-thirds of the length of the minute divisions. Hands made of this length will be found to mark the hours and minutes with great plainness, and the rule will be found to work well in dials of all sizes. As a general rule the extreme points of the hands should be narrow. The point of the hour hand should never be broader than the largest stroke of any of the chapters, and the extreme point of the minute hand never broader than the breadth of the minute lines, and in small work it is well to file the ends of the hands to a fine point. The end of minute hands should in every instance be bent into a short graceful curve pointing towards the dial, and as close to it as will just allow the point of the hand to be free. The minute hands of marine chronometers are invariably bent in this manner, and the hands of these instruments are usually models of neatness and distinctness.

Balancing hands by means of a counterpoise is a subject which requires some attention in order to effect the perfect poise of the hand without detracting anything from its distinctness. In watchwork, and even in ordinary clockwork, it seldom happens that any of the hands except the seconds require to be balanced, and then there is only one hand moving round the same circle, as is the case with seconds hands in general. We have become so accustomed to looking at seconds hands with projecting tails, that we are apt to regard the appearance of the hand to be incomplete without the usual tail; but we must remember that the primary object in view in having tails to seconds hands is not to improve the look of the hand itself, but to counterpoise it, which becomes an actual necessity for the hand placed on so sensitive a part as the fourth wheel of a watch or on the scape wheel of a fine clock. When only one hand moves in the same circle, like a seconds hand, the counterpoise may be effected by means of a projecting tail without in any way detracting from a distinct reading of the hand, providing the tail is not made too long and of such a pattern that the one end can easily be distinguished from the other. In minute hands, however, it is different. These two hands move round the same circle, and a counterpoise in the minute hand is liable at a distance to be mistaken for the hour hand.

The minute hand of large timepieces frequently require to be balanced, especially if the dial be large in comparison to the size of the movement; and in very large clocks, whatever may be the size of the movement, it becomes an absolute necessity to balance the hands. In our opinion, tails should never be made on minute hands when they can be avoided, and in cases where tails cannot be dispensed with they should invariably be coloured the same as the ground of the dial. In almost every instance, however, minute hands may be balanced in the inside, especially if the clock is being all made from the beginning. The minute wheels may be made large, and the one side weighted to balance the hand, or the pinion that moves the hour wheel may be extended through both of the frames, and a long arm attached to it that will work behind the back frame and balance the hand. A great many clocks used for railway and similar purposes have their minute hands balanced in this manner, and the plan works admirably; for, in addition to rendering the hands more distinct, the clocks require less power to keep them going than when the hands are balanced from the outside.

Such are our views on the subject of hands, and it will be observed that the whole question resolves itself into one where sound judgment and good taste only requires to be a little exercised on the part of the maker in order that all may be able to read the time on our various kinds of timekeepers with ease and accuracy.

(*To be continued.*)

BRITISH HOROLOGICAL INSTITUTE.

THE new premises of the Institute were formally declared open on Wednesday, the 8th ult., by the President, Sir Edmund Beckett, Bart., LL.D., Q.C., F.R.A.S.

The new Institute, a three story brick building, stands in Northampton Square, Clerkenwell, and contains a lofty lecture-room, class-room, library, and other offices. It was erected at a cost of £2,200, for which a total sum of £1,700 has been subscribed by the Baroness Burdett-Coutts, the president, the vice-presidents (Mr. John Jones, Mr. S. Jackson, and Mr. Glasgow), the treasurer (Mr. Mercer), the Goldsmiths', Clothworkers', Drapers', Skinners', Brewers,' and Clockmakers' Companies, the late Marquis of Northampton, Mr. Frodsham, Mr. Adams, Mr. E. D. Johnson, Mr. M'Cabe, the late Baron de Rothschild, Mr. Lousada, Messrs. Klaftenberger, Professor Tennant, and many other friends. It had been anticipated that the Lord Mayor and Sheriffs would be present at the ceremony, but they did not appear, and apologies were made on behalf of other influential persons who were expected.

The President, touching on the various subjects connected with the labours of the institute, deprecated the habit of over-valuing draughtsmanship and essay-writing. He said that some of the most skilful mechanicians of his acquaintance scarcely knew how to draw, and were better at doing their work than at talking or writing about it. With respect to technical education, he deplored that its best possible form, apprenticeship, should have gone out of fashion, partly through the obstacles thrown in its way by the trades unions, and partly through the weakness of parents, who dreaded that their children should have to "rough it." He commented on certain statistics showing that Switzerland and France make annually 2,000,000 watches, against the 200,000 manufactured in this country; and he remarked also on the fact that America has latterly gone far in advance of the United Kingdom in this skilled industry. It might be said that ours is a "very superior" description of workmanship; but, even granting this to be true, he pointed out that the whole world does not want "very superior" watches. In conclusion, he impressed on his hearers the necessity of diligence, and begged them to study excellence in their trade more attentively than the art of getting rich.

The Master of the Clockmakers' Company, Mr. Parker, said the Company were anxious to promote technical education, and proposed to offer a premium of £10 and the freedom of the Company for improvements which might possibly be made in some branch of work. If foreigners had machinery, so had we, and we ought to be able to compete with the Americans.

Mr. John Jones, vice-president, explained that prize essays, of which the president spoke so contemptuously, were not written by young men, but by masters of the craft—those "queer old-fashioned" men of whom Sir Edmund had spoken.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. VII.

(*Continued from page* 43, Vol. 5.)

Galvanic Batteries.—The terms denoting the various parts of a galvanic battery frequently puzzle the beginner, and lead him into difficulties, so that we think it advisable to give a short account of the nomenclature before proceeding with the descriptions of the various forms of the battery. The apparatus destined to supply—in greater or less quantity, and in a more or less constant and uniform manner—the electric or voltaic fluid, in its two different forms, the *positive* (vitreous) and *negative* (resinous), is called the *pile*. These fluids escape by opposite extremities of the apparatus; these extremities are called *poles*, and according to the nature of the fluid *positive pole* and *negative pole*. In a pair of piles or *element*, a single electro-negative agent is connected with a single electro-positive agent, and the combination of several of these elements is called a *battery*. The positive pole is designated by the algebraic sign + (plus), and the negative pole by - (minus).

The ribbons or wires which conduct the electric fluids to a given place are called *conductors* or *electrodes*.

When the poles, or the two metallic conductors carrying opposite fluids, are united, *the circuit is closed*, that is, the two fluids which the pile had separated, combine again to re-form the *natural* or *neutral* fluid.

When the extremities of the two conductors are plunged into a solution, without being brought into contact, it is said that this solution is *electrolysed*. The articles to be plated are generally attached to the wire starting from the negative pole (usually represented by the zinc plate) and these articles are then called *cathode* (signifying downwards). The positive conductor ordinarily finishes by a ribbon or wire of platinum, or by a sheet of that metal which the bath contains in solution, or by any other electricity-conducting body, such as graphite, or the residue of old gas retorts; this ribbon, wire, sheet, or conducting body is designated as the *anode* (signifying upwards).

There are two kinds of batteries used for electro-deposition—those which act under the action of physical agents—but those, on account of their feeble intensity, are rarely used. Others act under the influence of chemical reactions, of decompositions and recompositions, or of greater or less affinities. The varieties of these instruments, as regards both form and material are, at the present time, very numerous. But the best battery is that which, under the smallest volume, is the most energetic, constant, regular, and economical. We shall now describe several kinds which everyone can procure, or, if necessary, construct himself.

Daniell's Battery.—This battery develops a constant and lasting current, but is wanting in intensity. It is especially adapted to slow deposits, which must be thick and of uniform texture. A great advantage to this battery is, that it will work without acids, and therefore without the production of gases or smell, and can be used in a private apartment without inconvenience. The vase for the battery is a flat vessel of pure copper, which is half filled with a saturated solution of sulphate of copper, into which is placed a bag of canvas, or a cell of porous porcelain or earthenware, which causes the solution of sulphate to rise to about 1 inch from the top of the copper vessel. The bag or cell is filled with a saturated solution of common salt, in which a well-cleansed zinc plate is placed. It is necessary that the levels of the two solutions should be nearly the same. If there is any difference, the solution of chloride of sodium should be slightly above the other, because if the solution of sulphate of copper passes into the porous cell, the zinc is immediately corroded and blackened, and the battery may cease to work. When one of Daniell's elements only is used, which seldom happens, on account of the feeble intensity of the current, the conducting wire which supports the article to be galvanised is connected with the zinc plate by a binding screw of brass, and the other wire supporting the anode is connected with the copper of the exterior vase. The solution of sulphate of copper must be kept constantly saturated with crystals of this salt, enclosed in a bag of linen or hair cloth. A similar process may be employed to keep the solution of common salt in a state of saturation. A battery thus arranged may be kept in operation for three weeks or a month. When this battery is working, the copper of the decomposed sulphate is deposited upon the copper of the vessel, which thus increases in weight and in value. The zinc is slowly dissolved in the solution of common salt, and forms a double chloride of sodium and zinc. When a number of the elements of a Daniell's battery are to be joined together, the zinc of the first element is connected with the copper of the second by means of a well-cleansed metallic ribbon, then the zinc of the second with the copper of the third, and so on, until the whole apparatus presents at one end a copper vase, and at the other a zinc plate unconnected. A metallic wire connects the anode with the copper end, and a similar wire is bound to the zinc end, and supports the object to be electro-plated.

(*To be continued.*)

CHALFONT'S GOING BARREL AND STOPWORK.

It is often said that there is nothing new under the sun; it appears that there is at least nothing new in the shape of going barrels and stopworks. Only a few months ago, we had to record that the "improved going barrel" of Mr. Glasgow is nothing but a revival of an old idea, bodily represented at the Paris Exhibition in 1867, and published in Saunier's "Treatise on Modern Horology"; and now the current number of the *Revue Chronométrique*, a first class French horological publication of 24 years' standing, and under the able editorship of Mons. Saunier, informs us that a going barrel and stopwork, corresponding entirely in principle with, and varying but little in form from Chalfont's system, has been described in volume VI. of that journal, and practically employed in France more than twenty years ago; the only real difference being that the stopwork was placed inside, instead of outside the barrel.

As our issue of last August states, Mr. Chalfont's invention was awarded the Turners' Company's Silver Medal by the Horological Institute, and was designated as "a contrivance full of ingenuity, originality, and usefulness, such as promises to become an incorporate idea in the watchmaking of the world." Further comment is hardly necessary, and everyone can draw a moral from such circumstances. Of course, this coincidence of ideas nowise detracts from the merits of the gentlemen who have re-invented an old contrivance, but most forcibly demonstrates the necessity of an acquaintance with our horological literature, and the great value of our trade journals, and such complete manuals as Saunier's "Treatise on Modern Horology."

BRONZES.

By C. D. E. Fortnum, F.S.A.

(Continued from page 46.)

THE Etruscans were noted for their skill in the production of various articles of furniture and ornamental work in cast and beaten bronze. Their candelabra and lamps, which were exported from Etruria, and are referred to by Athenæus and others, are particularly graceful. Fine examples are preserved in the Gregorian Museum, and at Florence, and, at home, in the British Museum. The lamp found in the neighbourhood of Cortona, and now in the museum of that ancient city, is a wonderful specimen. Specially remarkable are the hand mirrors, or *specchi*, which were cast; one side being polished sufficiently to reflect objects, the other having subjects generally engraved upon the sunken surface, and more rarely in relievo. Many of these are works of great beauty. Some were contained in cases in which relievo subjects were produced by heating from within. The British Museum is rich in mirrors, Greek and Etruscan.

The art of damascening, or inlaying gold and silver beaten into incised hollows in the bronze surface was well known and practised by the Etruscans, as by the Greeks and Romans. This mode of enrichment was followed by the use of enamel in later Celtic and Roman times, and by niello. The value of coloured stones, ivory, and enamel, to give life to the eye, was also generally known. A statuette in the British Museum has, literally, diamond eyes.

We have already alluded to the working of bronze by the ancient Greeks as described by Homer and Hesiod, referring particularly to the shield of Achilles, and the shield of Hercules. The description of the gorgeous palaces of Menelaüs, and of Alcinoüs in the Odyssey would show, even allowing for poetical license, to what an extent the use of this metal had been adopted, and how frequently plates of brass, or more correctly bronze, were applied for the decoration of walls, furniture, &c. There can be little doubt that the larger figures, as of animals, &c., were not then fashioned by casting, but were *empæstic* works, or *sphyrelata*, covered with beaten plates of the metal. The colossal bronze Apollo at Amyclæ, in the neighbourhood of Sparta, was, according to Pausanias, little more than a pillar, with indication of head and hands which held the weapons. We may conjecture that in the earlier years of the seventh century B.C., Glaucus of Chios made great advances in metal work, by soldering, &c., while the Samian artists Rhœcus and his sons, Telecles and Theodorus, invented, or what is more probable, applied the art of casting to larger works by improved methods, perhaps their own discovery, perhaps learned by them from Egyptian artists.

About 550 B.C., the Cretans, Dipœnus and Scyllis, also worked in the Peloponnesus and in Aetolia, producing various sculptures in wood, ivory, and gold, and gilded bronze statues of Diana, Apollo, Hercules, etc.; their followers meanwhile establishing a school of sculpture in Sparta. Among others were Clearchus (or Learchus) of Rhegium, in southern Italy; Aristocles of Sicyon, Ageladas, Aristomedon, Dionysius of Argos. In Aegina Callon maintained the older and severer manner, similar in its rigid and minute style to that of the artists of Etruria. His bronze statue of Proserpine was celebrated. But he was surpassed by Onatus of the same island, who executed groups and statues, notably a chariot with four horses, dedicated by Hiero of Syracuse to Olympia, and placed there in 466 B.C. He is supposed by Overbeck and others to have been the sculptor who executed the Aeginetan marble groups, now preserved in the Glyptothek, at Munich, about 475 B.C. At Athens, Critias and Hegesias were sculptors in bronze.

We have now arrived at a period approaching that of the highest perfection in Grecian sculptures. Myron, the Bœotian, who was one of the most distinguished among the pupils of Ageladas, worked like his master for the most part in bronze, and is said to have preferred the Aeginetan alloy. Celebrated was his group of Jupiter with Minerva and Hercules at Samos, which Antony carried to Rome; Augustus, however, having restored the other statues to the Samian temple of Timo, detached the Jupiter, and placed it in a shrine in the Capitol. His Erechtheus at Athens, and a Bacchus were also famous; an Apollo at Ephesus; another inscribed with the sculptor's name at Agrigentum, and a Perseus conquering Medusa. Pliny tells us that a Hercules by Myron was in the house of Pompeius in Rome A group of Minerva and Marsyas, of which latter figure there is an antique copy in marble in the Lateran museum, is among the most renowned of his works in bronze, which are recorded by the ancient writers; to this we must add the world-celebrated cow. His manner was energetic and masculine, and his subjects for the most part in spirited and vigorous action rather than expressive of mental or bodily repose. The figure of the Discobolus, described by Lucian, and well known to us by the antique marble reproductions in the Vatican, the Palazzo Massimo, and elsewhere, is a characteristic example of his style, as was the statue of the celebrated victor at the Olympic games, Ladas the runner.

To Cresilas, a follower of the school of Myron, has been ascribed the statue of a wounded Amazon in bronze, of which some antique copies in marble are still extant; the finest, perhaps, that in the Capitoline museum at Rome. He also executed a bronze of a wounded warrior in the last throes of his waning life. He made a portrait bust of Pericles, of which those in marble in the British Museum, the Vatican, and at Munich may possibly be copies.

Callimachus and Demetrius, artists of the same period, though somewhat influenced by their greater rivals, pursued to a certain extent an independent manner. To Callimachus has been ascribed the invention of the Corinthian capital in architecture, the minute beauty of which would suggest an original of metal. The adaptation of the graceful leaf of the acanthus to architectural decoration might well suggest itself to a mind constituted like that of Callimachus, as evidenced by the established character of his works—namely, high elaboration of details. Demetrius, naturalistic and minute in his execution, was much occupied in portraiture, in which he was thought to be over exact, even perpetuating small defects.

The zenith of Grecian art was comprised within the short space of a quarter of a century, from about 460-430 B.C., when Athens was for the most part under the control of Pericles. Pheidias, born about 500 B.C., was probably the greatest sculptor of any age. It would appear that he first began his artistic career as a painter, but subsequently repaired to the school of Ageladas. Unlike Myron, his works are imbued with the highest intellectual sentiments, and he executed them in various materials. Some of his earlier productions, as might be anticipated from his schooling in the studio of the bronzist Ageladas, were of that material. Thus, we hear of his group of thirteen bronze statues presented by Athens to Delphi, in memory of the victory at Marathon; it represented Miltiades surrounded by the Attic heroes, and supported by Apollo and Minerva. He also cast colossal and other figures of Minerva; particularly that made from the bronze spoils of Marathon, which, some 70 feet in height, rose crowning the summit of the Acropolis, and became a typical representation of the goddess.

(To be continued.)

TRADE RECIPES, &c.

Action of Aqua Regia on Platinum.—Mr. Edison finds that platinum, after it has been rendered homogeneous under the vacuum treatment, is dissolved with great difficulty in boiling aqua regia. He subjected a specimen of the vacuum-treated platinum to the action of boiling aqua regia for five days without dissolving it.

To Remove the Chalky Appearance of Silver after Plating.—When articles are taken out of the electro-plating solution they are swilled in water and then put into boiling water. They are afterwards put into hot sawdust, which dries them perfectly; their colour is then a chalk-white. They are generally weighed before using the scratch brush with old ale, beer, or water containing in solution a little gum, glue, or sugar. Afterwards burnish by the usual method, and although this operation does not displace any of the silver, still, in taking off the chalky appearance, there is a slight loss of weight. The appearance after scratching is that of bright metallic silver. A little sulphuret of carbon added to the plating solution prevents the chalky appearance, and gives the deposit the appearance of metallic silver; the reaction which takes place in this mixture is not yet understood. The best method of applying the sulphuret of carbon is to put one or two ounces into a large bottle, then fill it with strong silver solution having an excess of cyanide of potassium, and let it repose for several days, shaking it occasionally. A little of this silver solution is added, as required, to this plating solution, which will give the articles plated the same appearance as if scratched. It is also found that the presence of sulphuret of carbon prevents the solution from going out of order; indeed, we have seen a solution that has been constantly working from two to three years, while, generally, they were subject to go out of order, for a time, in less than one year—although, after standing a time, they would recover—but these are curious reactions not yet investigated.

Covering Iron and Steel with Copper without a Battery.—Herr Graeger, an eminent German metallurgist, recommends a process for this purpose which is said to give most satisfactory results. The objects are first well cleaned, and then painted over with a solution of protochloride of tin, and immediately afterwards with an ammoniacal solution of sulphate of copper. The layer of copper thus produced adheres so firmly to the iron or steel, that the different objects can be rubbed and polished with fine chalk without injuring the deposit. The *tin solution* is prepared with 1 part crystallized chloride of tin, 2 parts water, and 2 parts hydrochloric acid; the *copper solution*, with 1 part sulphate of copper, 16 parts water, adding ammonia sufficient to re-dissolve the precipitate first thrown down by it. Zinc and galvanized iron can be treated, according to Boettger, directly by the copper solution, without using the tin salt. The above process may be found useful by gilders, and for various ornamental purposes. Herr Weil, another metallurgist of repute, gives another process which yields a coating of copper of great brightness and strong cohesion. The object, whether of cast or wrought iron, is freed from rust by immersion for from 5 to 10 minutes in water containing 2 per cent. of muriatic acid, and subsequent scrubbing for a quarter of an hour with a wire brush and sand, then washing in water until all traces of acid are removed. It is then covered with zinc wire in spiral turns of about 6 inches from each other, which also serves as a means of suspension. The bath consists of a solution of 8 parts caustic soda in 100 parts water of which 11 quarts are mixed with 50 ounces Rochelle salts and 12½ ounces sulphate of copper, making a liquid of a density equal to 19° Baumé. It retains its activity as long as the copper is kept replaced, and deposition from it proceeds with great regularity. The material of the vessel is best when made of wood, lined with gutta-percha, and covered with a wooden lid. When the coating is of sufficient thickness, the object is removed from the bath, first washed with water slightly acidified with sulphuric acid, and then with pure water, until the disappearance of all traces of acid; after this it passes into a drying-room heated to 132° Fah. The bronzing, when required, is obtained by a bath of sulphide of sodium, or by means of the same bath as above, somewhat modified, that is, by increasing the proportion of copper to a threefold, in which case the bath no longer deposits copper, but, to all appearances, bronze. By reducing the points of contact between the iron and wire, though retaining the spiral turns at uniform distances, the deposit gradually assumes a number of colours in the following series—viz., orange, silver-white, pale yellow, golden yellow, carmine, green, brown, and dark bronze. As soon as the desired colour is attained, the object is washed in warm water, and again dried at 132°. Between each subsequent change of colour is an interval of about 5 minutes. The reaction is more decided when the alkaline reaction of the bath is stronger. For indoor work or ornaments the time of immersion may vary from 3 to 72 hours; for outdoor objects a much longer time would be necessary.

(*To be continued.*)

NEW DESIGNS IN GOLD AND SILVER JEWELLERY.

WE are glad to observe that our manufacturing goldsmith's are more and more recognising the necessity for supplying the trade with articles of jewellery, the designs of which are in harmony with that refined artistic taste now asserting itself in every branch of art industry. Every educated person has nowadays some more or less elevated idea of what constitutes a "thing of beauty;" an ugly-shaped piece of gold or silver whatever its weight, and however highly estimated by Cetewayo's tawny consorts, is no longer considered fit ornament for our art-loving belles. The object of jewellery is not to vulgarise nature, but to enhance or to set off natural charms; it thus behoves purveyors of these ornaments to provide something capable of answering such a purpose. Those of our manufacturers who constantly pursue this aim will certainly meet with encouragement, and success cannot fail, because they supply their customers with goods acceptable to the purchasing public.

We are always pleased to take notice of any steps in this direction, being convinced that we are well serving the trade in calling attention to genuine and desirable novelties. Mr. S. Brame, of Messrs. Ball and Brame, the well-known manufacturing jewellers, of 18, Northampton Street, Birmingham, has just forwarded us drawings and specimens of some beautiful and unique designs in jewellery, displaying an amount of taste and skill that will certainly secure them a ready and extensive sale. The leading feature of these ingenious novelties is a Chain Border (Registered), a clever combination of various gold and silver chain patterns, adapted as borders for brooches, pendants, lockets, solitaires, bracelets, etc. The centre consists of engraved monograms, or saw-pierced and engraved subjects, but the Registered Chain Border is applicable to every variety of jewellery, and some of the patterns would adorn gem-set centres as well as plain gold or silver. From the handsome specimens before us we have no hesitation in recommending these attractive goods as a most suitable addition to select stocks.

During the month ending August 31st, 73,787 clocks, valued at £42,744, and watches to the amount of £32,072 were imported into this country.

CURIOSITIES OF CLOCKS AND WATCHES.

(*Continued from page 49.*)

IN 1767 a person named Highs or Hays, a reedmaker at Leigh, took up the plan of attempting to spin by rollers. He made experiments for this purpose, and employed Kay, a clockmaker, to assist him. It does not appear that they achieved any success. Richard Arkwright was at that time a barber and peruke maker in Bolton. In his accustomed journeys in his business he made the acquaintance of Kay, then removed to Warrington, and from him learned the attempts which were then being made by Highs. Arkwright adopted the inventions and improvements, and appropriated them to his own use. He afterwards erected works at Crumford, in Derbyshire, and acquired a fortune of nearly half-a-million sterling. His system of machinery, to which he gave the name of a "Spinning Jenny" has given employment to countless thousands of people, and been productive of vast commercial advantages to this country. How much of that success was due to the mechanical genius of the clockmaker we are left to guess; but we may fairly assume that the reedmaker and the barber knew less of the details of machinery than he did.

An old and excellent hall-clock in the city of Philadelphia bears the name of Devereux Bowly, of Lombard Street, London, as the maker. He died March 15th 1773, in the seventy-eighth year of his age. He was a member of the Society of Friends, and being at the time of his decease a widower and without a family, he left a large portion of his property to their school, then at Clerkenwell, in the neighbourhood of which he resided.

James Cox, of No. 103, Shoe Lane, Holborn, was an eminent watchmaker, jeweller, and mechanician of the last century. When there was a prospect of the interior of India being opened to British enterprise, he made a number of curious splendid and costly toys of the richest materials, hoping to sell them profitably to the Indian princes. His design was, however, frustrated by the breaking out of war, and his articles being quite unsaleable in the European markets, he endeavoured to turn them to account by exhibiting them in a museum in Spring Gardens in 1773 and 1774.

These artistic figures were described in the catalogue as "exquisite and magnificent pieces of mechanism and jewellery." The insecurity of property at the period compelled Cox to take the strictest precautions to guard his treasures; only a few persons were admitted at a time, twice in the day, and the charge for admission was half-a-guinea. This expedient proving very unremunerative, he in 1773 obtained a private Act of Parliament, empowering him to dispose of his museum by lottery; this Act received the royal assent by commission on June 21st, in that year; and on May 1st, 1775, the drawing commenced at Guildhall. Cox was not merely an ingenious mechanic; he was probably the first of his trade in England who studied artistic effect; and he employed Nollekens, the sculptor, and Zoffany, the painter, to make designs for his works. The preamble to this Act of Parliament states that "the painter, the goldsmith, the jeweller, the lapidary, the sculptor, the watchmaker, in short, all the liberal arts have found employment in and worthily cooperated" in his museum. The fifty-six "pieces" comprising it were valued at £197,500, and were all of a most rich and rare character. Among the many beautiful specimens of clocks and clockwork enumerated in the descriptive catalogue was "Piece the Forty-second, a Cage of Singing Birds."

"It is placed upon a most superb commode of gold and lapis lazuli, set in frames of silver and panels of gold, ornamented with the greatest taste and elegance, with trophies of finely adapted designs; the cage is supported at the four angles by rhinoceroses, and in the front by an elephant. The commode contains a fine set of bells, that rings changes and plays many curious tunes. The doors in front, when opened, discover a grand cascade of artificial water falling from rocks; besides this, fresh streams are poured down from dolphins, and blown up by Tritons out of their shells; while a number of mirrors, placed in the cavities of the rock, reflect the whole, and render the effect most pleasingly astonishing. Upon a superb pedestal stands a cage of incomparable richness and beauty, composed of gold, silver, jewellery, and agate; it is designed from an elegant architectural plan wrought in silver and gold, with an execution truly masterly; under the doors of the cage several birds are seen in motion; on the right appear a nest of birds fed by the old one, on the left, birds are seen picking fruits and flowers. Upon the cage is an eight-day musical clock, that chimes, strikes, and repeats, has two dials, and at the right and left of the cage gives motion to vertical stars in jewellery. Above the clock is a temple of agate, adorned with pillars of silver and ornaments of gold and jewellery; in front there is the representation of a house, with a mill, bridge, people, and other pleasing objects in motion. Above the temple is a hexagonal pavilion, in the centre of which is a double vertical star, terminating with a large star, in spiral motion, that seems to extend its points. Within the cage are a bullfinch and a goldfinch, all of jeweller's work, their plumage formed of stones of various colours; they flutter their wings, they warble, and move their bills to every note of the different tunes they sing, which are both duets and solos, surprisingly melodious, to the universal astonishment of the auditors."

Another article in Cox's museum was a large eight-day clock, which was described in the inventory as follows:—"It stands upon four superbly chased and gilt feet, bordered also in several parts with wrought frames, moulding, and other embellishments. At the angles of the case are richly chased therms, with ornaments of flowers dropping loosely down. Upon the corners are gilt vases, and upon the centre of the top is an octagon temple, standing in a quadrangular ground, at the corners of which are four gilt pine apples. The dome of the temple is blue and gold, terminating with a gilt vase; within the temple is a moving procession of the various characters in Shakespeare's 'Jubilee.' This elegant case contains a very excellent musical clock playing eight tunes; the enamelled dials fixed within a finely wrought, highly embossed, and richly gilt frame, supported by lions couchant. Above the dial are a wind and water-mill, a horse grazing, and a mason working. By the side of the windmill is a cart, which is both loaded and unloaded alternately, and is always moved by the movement of the clock; the miller, moreover, is seen descending from the mill, and the sacks are conveyed to and placed regularly in the cart till full, when it is again emptied, and this succession of changes is continued perpetually. The water-mill is equally curious and pleasing; the river is seen to flow, the water-mill to work, and the water run down under the wheel; the door of the mill also flies open, and discovers the miller standing within by the side of the hopper, in which the flour descends, and after so continuing for some time the door closes again, and the motion ceases."

In this inventory of clock-work rarities is a description of the chronoscope, the fellow to which was presented to the Emperor of China in 1769. This timepiece, which was richly embellished by many costly ornaments, contained a curious clock, with dials in each side. They were made of crystal, so as to show the motions of the clock; each dial was divided into three parts, containing a minute, a second, and an hour hand, and a fourth dividing the minute into two hundred and forty degrees. Besides a great weight of gold, there were nearly one hundred thousand precious stones, including diamonds, rubies, emeralds, and pearls, used in the embellishment of this chronoscope.

(*To be continued.*)

HINTS TO REPAIRERS.

(*Continued from page* 47.)

We often find one of the pivots of a pinion or staff either broken or badly worn, and instead of putting in a new pinion or staff, we can, by putting in a new pivot, make the old one answer just as well as a new one. The greatest difficulty any one has to contend with in putting a new pivot is to drill the hole for the pivot; this being accomplished, the rest of the work is comparatively easy.

We will commence with the upper centre pivot, and consider them all *seriatim*, premising, of course, that the watch is one the hands of which are set in the face. Hold the pinion with a pair of tweezers, grasping it by the bases; then, with a blow-pipe having a small aperture, and an alcohol lamp, draw the temper from the extreme end of the pinion, being careful not to heat it so long or so hot as to discolour the leaves of the pinion. Holding it as directed above materially assists in preventing this.

As the lower portion of the pinion—that part on which the cannon pinion rides—does not often run true with the lower pivot proper, it is always best to true up the pinion in the lathe by the lower pivot, the upper part of the pinion being in the chuck; then make a centre in the projecting end, after which reverse the pinion and true up as before; make a small but perfect centre in the end with a sharp-pointed graver, being careful not to leave a little "tit" in the centre, which will now be ready for the drill.

Take a piece of Stubb's wire, small size, or a needle, which is what we usually use; draw the temper, then file down to about the size that you intend your pivot to be, filing it nearly straight for at least one-eighth of an inch from the end, then flatten it on the extreme end with a hammer. Do not flatten it with a *single* blow of the hammer, but strike it lightly, so that you will have to give it several blows; by so doing your drill will not be as liable to crack and crumble when in use. Heat the end red hot, being careful not to burn it, then quickly plunge the end into oil. It is now hard, for say, half an inch from the end; make it bright with emery paper, then hold the butt end with a pair of plyers, and the very extreme end of the pivot in a pair of tweezers, and carefully draw the body of the drill down to a deep blue, and you will have a drill that is very hard in the point, and very tough immediately back of the same. Now lay it on a piece of metal, and draw the point down to a very pale straw colour. With such a drill you can drill any pinion or staff that has had the temper drawn to a very light blue, or nearly black. Turn the lathe very slowly, using but slight pressure and plenty of oil, and you will soon have a hole deep enough for your pivot, which should never be less than the length of the pivot, and ought to be twice as deep, unless for very small pivots, when one and a half times as deep will answer. This rule holds good for all except the lower fourth pivot, which, being very long, does not require a hole as deep as it is long. Take a good needle—none but the best quality must ever be used for drills or pivots—and draw the temper to a deep blue, being careful not to pass that point, or it will be too soft. The blue should be of the kind which we always see in tempering polished steel, when it is just passing from a purple to a blue, for very fine work. We always stop at that point just as it is entering the blue. File it to fit the hole, so that it will require some forcing to get it down to the bottom; cut it off before forcing it in sufficiently long to allow for the point, and force it in with a few light taps of the hammer; then turn and polish, just the same as if working on a new pinion.

The upper third pivot is put in just as directed for the upper centre. The lower third as well as the lower fourth pivots require more time and care, for we cannot draw the temper in either of these, and our drill will not cut to our satisfaction. After having centred for lower third, make a drill as previously described, omitting the drawing of the point to a light straw, as in this case we must have a very hard drill. We omitted to mention, in directions for making a drill, that after it was tempered properly, it should be held in a pin vice, and, with the flat side resting on a piece of Arkansas stone, take another piece of Arkansas stone and grind it down flat, then sharpen it, when it will be ready for use. With such a drill, plenty of oil, and turning the lathe very slowly, not over one or two revolutions in a second, and using considerable force on the drill, a hole can be made deep enough in less time than one could think, for the great trouble is, we get in too much of a hurry, and either *force* the drill too much or bend it to one side; consequently, in either case, have a broken drill, and in some instances it takes some considerable time to remove the piece of drill left in the hole, besides having a new drill to make. If you break a drill, don't be so foolish as to get mad, but quietly file up a piece of tempered steel and "pick" at it until you get it out. Same directions apply for putting in the pivot as for the centre. The upper and lower fourth, same as upper and lower third. The 'scape pivots are usually put in same as lower third; sometimes we remove the 'scape wheel and draw the temper for the upper pivot. The pallet-staff pivots can be easily put in, as either end can be "drawn," always polishing up that part that was discoloured by the heat, of course.

In putting in a new pivot in the balance-staff, *always* remove the balance if an upper pivot is needed, and generally so if a lower one is to be put in; then draw the temper, holding the opposite end in a pair of plyers, first wetting the jaws of the plyers to insure perfect protection to the opposite or good pivot. After having finished the pivot, if an upper one, or if the lower, the staff must be reversed and trued up, fit on the balance, and rub it in tight with a burnisher. If the balance is an "adjusted chronometer balance," great care must be exercised and not overheat it, as its adjustment would be materially affected.

Although we gave directions for putting in a new upper centre pivot in a former number, we thought it best to go more into the details this time, and include the other pivots, so as to have the whole subject of putting in a new pivot complete in one article. We hardly deem it necessary to give detailed directions for putting in a new third or fourth wheel; suffice it to say, before riveting them in, they must be trued up by the periphery, and the hole in the centre made concentric with the outside or extremities of the teeth.

(*To be continued.*)

The prize of £100 placed at the disposal of the Society of Arts, by Mr. E. J. Watherston, for the best essay on the silversmiths' trade has been awarded to Mr. Herbert Singer, together with the society's silver medal.

The following is from the *Sydney Morning Herald*, of September 1:—"The Exhibition has attracted here a large number of agents from Europe and America anxious to do business for manufacturing houses. There seems to be a wrong impression abroad as to the consuming powers of Australasia, and this may have arisen from the lavish expenditure in gold digging times. Things are changed now, and daily settling down to their normal condition. At best there are only the wants of less than three millions of people to supply at present, and to attempt to force trade must only result in a loss."

THE SILVER TRADE AND HALL-MARKING QUESTION.

THE able letter of "An Old Hand" which we reproduced in our last from the *Sheffield and Rotherham Independent* has given rise to some further correspondence on the same subject. It is true we have already largely treated this question in our pages; but it is one of such vital importance to the trade that too much cannot be said upon it, and we gladly avail ourselves of any practical suggestions, from whatever section of the interested trades they may emanate:—

E. J. Watherston writes: "The letter of 'An Old Hand' in yesterday's issue is one deserving of the most careful consideration of members of the silver trade in Sheffield.

"Your correspondent deals with the subject in a truly practical manner. I am glad to be assured that a belief is gradually spreading that the reforms so persistently advocated by myself and others (notably so unanimously in Scotland) are in no sense 'Radical,' but in the highest degree 'Conservative' of the best interests of manufacturers and workpeople.

"The fact is before us that the silver trade is gradually dying out in this country. Every year shows a decline. The returns just published prove that we worked up 42,912 ounces less in the year ended March 31st, 1879, than in the corresponding period of 1878. In the quinquennial period, 1875 to 1879, the fall is 146,254 ounces. In the quarter of a century, from 1855, it is 254,121 ounces. Our exports show a similar decline, viz., from 156,440 ounces in 1855 and 120,280 ounces in 1875, to 85,121 ounces in 1879. Our home trade is not quite half what it was half a century ago.

"It is quite true that 'electro-plate' has had its effect upon the production of 'silver-ware,' but for this very reason I, as a silversmith, maintain that the law which taxes one trade and leaves the other, and that other such a powerful competitor, free, is unjust in the extreme. The silversmith must always remain under a natural disadvantage, as compared with his rival, the electro-plater, by reason of the greater cost of his raw material; but why that raw material should be enhanced in cost by the amount of 35 per cent. is a mystery to all who have seriously considered the subject.

"However, but little need be said about the duty; it has been all but unanimously condemned by a Select Committee of the House of Commons, and a few months will see the last of it. That the removal of this fiscal (and almost prohibitory) hindrance to trade will be of immense advantage to both manufacturers and workpeople, no one who has any acquaintance with the history of his country can doubt for a single moment.

"That the reform will injure the electro-plate trade I utterly deny. I believe that electro-platers will benefit by the change, as they will largely increase their silver trade in competition with glass and porcelain manufacturers, whose centre pieces and table ornaments now sell largely to people who would not have an article of electro-plate in their houses, but who, for two reasons, will not buy silver (1) because it is so expensive (a result of taxation), and (2) because it is so ugly.

"This brings me to the second part of the subject—hall-marking. I maintain that the principle of compulsory hall-marking, as at present practised, is responsible for the inartistic character of our modern silver plate, and that a reform—not a revolution—is urgently needed before we can hope for any improvement. The reform I believe to be needed is this: hall-marking must no longer be compulsory; it must be a voluntary institution, carried out by the present authorities, under altered conditions, and by improved methods. The hall-mark should rightly be called the national trade mark; it should be rendered easily available to manufacturers. The 'lion' is our silver mark. Let 'the lion' so continue to remain, the guarantee of the quality of silver goods. An article should likewise bear the maker's initials or trade mark. These two marks will alone suffice for a guarantee of quality. 'The lion' will remain the protected trade mark of the various assay offices. The 'Queen's Head,' or duty mark, will of course be discontinued directly the tax is abolished. The 'Town Mark' should be discontinued in the interests of country manufacturers, who at present are in many instances obliged to send goods to be marked in London rather than they should be condemned as 'country made,' 'only Birmingham,' or, as the Jew dealers say, 'Oh! I can't give you more than so much an ounce for that—it is only Irish.' I myself have ordered plate to be made in Sheffield, and to be hall-marked in London, for this very reason.

"Again, the date mark should be abolished at once. Why on earth should a silversmith be bound to have his wares dated, and thereby turned into 'old stock' if they do not sell in a few weeks or months? Can anything be more senseless than such a proceeding? Would any other trade in the country allow such a ridiculous hindrance to prevail for a moment longer than they were obliged?

"But, it may be said, how is the Assay Office to be supported? The answer is simple—as it is now. Hall-marking will not die out; it will be as general after reform as now; and, in addition, there will be more goods to be hall-marked. The Assay Offices are now supported by hall-marking; the Sheffield office only earned £64 in 1877, and £65 10s. in 1878, for collecting the duty. The offices must be 'self-supporting,' or they must be closed. Such was the fate of the 'York' Assay Office; it has been closed for years. The way to make them 'self-supporting' is by making them most readily available to manufacturers. There is no reason why they should not offer facilities for hall-marking electro-plate. The Sheffield Assay Office at present does not mark gold wares. Under a voluntary system it might add that to the number of its duties. Thus the trades of watchmaking and jewellery could be established in Sheffield."

Another correspondent writes:—

"The evidence taken before the Committee on Silver Plate made clear that among other objections to the duty is the unfair and unequal way in which it is levied, bearing heavily upon one branch only of the manufactures in which silver is used, and leaving others quite untouched.

"A gentleman seated at his dinner table will find that his spoons, forks, and other utensils, if made of silver, have among other marks an impression of the Queen's head. This indicates that in the cost of those articles he has been charged about 20 per cent. as silver duty and hall charges. He may also have in the middle of his table a grand electro-plate centre piece, with a quantity of silver deposited on it sufficient to make many spoons and forks, but on which he has not paid one farthing of duty. If he examines the case of his watch, whether it be of gold or silver, he will find similar marks to those on his spoons and forks, with the difference that the Queen's head is absent, showing that though it has paid hall-marking charges it has paid no duty, and that is because it was thought wise to thereby encourage the growth of the watch trade. If, again, his wife and daughters should be wearing any of the silver jewellery now so fashionable, he will find on examination that there is no mark whatever to show that it has been officially inspected and assayed either to guarantee its quality or as evidence of a duty having been charged upon it. It was stated to the committee that there was good reason to believe there are tons of this kind of personal ornament sent from Birmingham in the course of a single year in the shape of brooches, lockets, armlets, necklaces, head ornaments, and waist belts, not one ounce of which has paid any duty to the State. Mr. Giffen, of the Board of Trade, showed to the Committee a silver girdle, weighing twelve ounces, and had reason for believing that others are made weighing as much as twenty ounces each, and these are exempted from duty because they come under the denomination of chains, and all silver chains are duty free. The maker of articles for domestic use must not sell a peppercaster top weighing perhaps three pennyweights, of which twenty go to make an ounce, without paying duty to the amount of about twopence-halfpenny. This swallowing of the camel and straining at the gnat, puts the whole matter in so absurd a light that one cannot wonder at a Parliamentary committee, comprising in it men of the calibre of Mr. Goschen whose searching and intelligent queries did so much to bring out the truth, should have condemned it by eleven voices to one. The whole system, if it be a system, has grown up in so haphazard a manner that no part can be dovetailed into another, and it must be at once reformed when brought before any assembly of men with ordinary business aptitude.

"Many think they have closed any discussion on this question when they affirm that silver plate is a luxury, and that luxuries are the most fit subjects for taxation; but besides the general answer that England has long abandoned the principle of taxing luxuries simply as luxuries, it is open to the immediate rejoinder—Why tax only one kind of luxury and leave all others untaxed? A lady at her tea table may have decked herself with diamonds to the value of a fortune; she may be wearing the most costly fabrics, lace of the finest quality, or some of those East Indian cloth of gold tissues of which samples may be seen in our Museum, priced at seven guineas per yard; everything around her may be of the rarest and most costly kind; yet not one of them will have paid a tax except her silver tea equipage, among the most useful and indispensable articles in the whole room. It is in vain to look for any rule in all this; there exists none; and one result may be seen in the impressive letter from Mr. Watherston in last Saturday's *Independent*. The trade is dying of strangulation; not even the inflation at the beginning of the decade, when all kindred trades were so stimulated, could do more than give it a feeble and languid impulse; and its death seems only a question of a certain number of years unless its bonds be severed and its circulation once more healthily restored by the removal of all hindrances to its natural growth.

"The opposition of the manufacturers and shopkeepers to the proposed change is partly accountable on the ground that they have large stocks on which duty has been paid; but the officials of the Board of Trade say that arrangements may be made in this as in other previous abolitions of duty, by giving sufficient previous warning, and by the granting of drawbacks on stocks in hand. It will no doubt be an awkward turning point, leading to much temporary inconvenience; but it must be faced. Mr. Farrer, reasoning from his large experience in similar cases, in answer to Mr. Goschen's question, 'You believe that the operation of the laws imposing hall-marking, coupled with the fiscal arrangements, has simply diminished the employment of silver for manufacturing purposes?' replied 'Certainly! No one can possibly tell what the effects of taking off a restriction and a duty are, but all experience shows that restriction and duties tell much more widely and largely than you would imagine they would at first. I think I may say another thing, that the trade are very little to be trusted when they say that they wish to retain a restriction and a duty. Experience shows that trades who are subject to a restriction and a duty are very often the last people to wish them taken off if they think it will admit general competition.'

"Some seem to imagine that we are about to see a reversal of our commercial policy and a return to that so graphically illustrated in the letter of Mr. John Wilson in last Saturday's issue, but that is a very forlorn hope indeed. When they can point to one case in which a measure of great national importance has, after long continued agitation and full and free discussion, been decided by a vote of Parliament in the affirmative and afterwards revoked, I will begin to think there may be something in their agitation; but if they cannot, I will continue to look on it as something that may do to pass the time on till we have more profitable occupation.

In another communication the same correspondent states:—

"It was brought out in the inquiry on the silver duties that the manufacturers and the shopkeepers are as a rule opposed to any change in the existing arrangement. Their reasons may be good or bad, and their power considerable for the prevention of any change. But they will do well to consider who are the most strenuous among the opponents of the present order of things. Two of the chief among the permanent officials of the Board of Trade, Messrs. Giffen and Farrer, were examined by the committee, and they were both dead against the retention of the silver duty. Now, these gentlemen are of a class who can make their influence felt in a way that no other can; they, more than any other men, have occasion to know all about the trade of the country, and they have more perfect means of arriving at just conclusions on the working of the laws regulating that trade than any other class. And it is to them that Ministers, who may be in office to-day and out of it to-morrow, must refer for information and opinion on the working of our commercial code these men spend a long life in their particular offices, and must necessarily accumulate information and experience which cannot but have a powerful, though not a publicly apparent, influence in shaping our legislation.

"Mr. Farrer seeks to raise the silver duty question to the position of one of national importance. He holds that the duty and the compulsory hall-marking act as hindrances to the use of silver in manufacturing, and that by discarding them more silver would be absorbed and taken out of the market, and that the effect would be a steadying in the exchanges with India—the fluctuations in the value there having already been the cause of great inconvenience in that important imperial dependency. If Parliament can be persuaded that this is a correct view, it will greatly facilitate the abolition movement, as it is only reasonable that the interests and prejudices of a limited class should be forced to give way when they stand opposed to those of the nation in general.

"It cannot be disputed that there are others beside manufacturers and shopkeepers who have an abiding interest in the prosperity of the silver trade, and to whom its extension and development in the direction of design and workmanship are matters of vital importance. There is much in this report that they will do well to ponder over, and endeavour to find a satisfactory reason for. Mr. Farrer related to the committee how the Board of Trade, wishing to make a present to a French gentleman who had rendered some service, he declared his preference to be for an English silver tea service, and that he, Mr. F., accompanied by an artist friend on whose educated taste he relied in making the selection, made the round of the chief London silversmiths' shops. After seeing no end of stocks, which they found to consist mainly of the same unsatisfactory patterns over and over again, they pitched on an elegant and novel set, but found to their mortification that it was made by Christofle, of Paris, and consequently would not meet the French gentleman's desire, and they ended the matter by buying a copy of an old set made in the reign of Queen Anne. Assuming that those gentlemen had no bias in their minds against English art work, it is certainly an unsatisfactory outcome to all the Kensington Museum and school of art teaching we have had in the last forty years. It cannot be disputed that other kindred industries have been most successful in wedding art teaching to industrial production, for, besides the glass trade, we can reckon the pottery, the furniture, the lace, and other trades as having established a high reputation throughout the world for every excellent quality, so that in these we stand second to none. Even at Philadelphia, where our great house of Elkington made so grand a display, it appears from the American jury report that the high honours were awarded for their exceptional works, which were got up regardless of expense; but that their ordinary domestic wares were judged inferior to those produced in America. It is affirmed that while there are at South Kensington many who are earnestly studying design as applied to our more expansive and flourishing industries, there are none who turn their attention to designing for silver work. It is said the trade is too limited, too inanimate, and too unenterprising to offer any prospect of remunerative employment for trained talent. If this be a fact, it is a curious one in combination with the other fact that it is virtually a protected manufacture, the conditions on which foreign goods can be put on the English market being so unfavourable that they are practically prohibited.

"Sir R. Peel's Free Trade measures threw open our markets to the glass of Bohemia, of Venice, and every other glass producing community, yet English glass has flourished, and held its own, and there is not a kind of ornamental glass, of either ancient or modern make, that has not been imitated; even the process by which the world-famous Portland Vase was made has been revived, and original works brought out emulating all its highest excellencies. These things have not been achieved without the most devoted perseverance, and by a rare union of artistic taste working in combination with the most perfect handicraft. The glass workers have had all the world to compete against, yet hold their own at every point; but our silversmith's, if we are to believe what is said, is but a backward business in comparison with that of other countries.

"Should the duty be abolished and the hall-marking arrangements made more easy to foreigners, we may look out for a lively competition. Even now, Tiffany, of New York, is said by their agent to be arranging to put their goods on the English market, and as they are the people who took the grand medal in Paris last year our silversmiths may look for a wakening up. Like the glass workers, the trade must leave no means untried for producing the highest excellence, for if Englishmen can excel in the working of other materials there is no reason why they should not do so also in silver.

The Japanese Government intends to augment its import duties. Hitherto, a 5 per cent. *ad valorem* duty has been the rule, but the proposed new tariff will exact 20 per cent. on clocks and 25 per cent. on watches.

A correspondent of the *Scotsman* says that two gold rings, as well preserved as if new made, have been picked up in the vicinity of Maeshowe, at Loch Stennis, Orkney. The pattern on one of the rings is three-plait, and that of the other is a plain double cord, both being united into one ornament by cross-bars. Some of the local antiquaries have decided that the rings must be about 1000 years old. They are now in custody of the county clerk.

Since 1877, the Paris Municipality has been studying how to obtain a unification of time all through the city. It has at last made up its mind what to do. A standard-regulating clock is to be set up at the Observatory, and electric communication will be established between this and twelve auxiliary regulators, which in turn will be electrically connected with the clocks to be regulated. The Telegraph Department has contracted to set up the necessary wires for 86,000 francs, and to keep them in repair for 7,500 francs a-year.

TECHNICAL EDUCATION.

The City and Guilds of London Institute for the Advancement of Technical Education is now an accomplished fact, and it is to be hoped that the movement will be carried on with a will and energy sufficiently strong to secure its success. The programme for the Technological Examinations for 1880, embracing twenty-six different subjects, is now before us, and to our great satisfaction we find that the watchmaker and jeweller has not been forgotten. It is true, we should have liked to see the technical education of watchmakers under the direct care and supervision of the British Horological Institute; but the present experiment will no doubt lead to some such arrangement sooner or later.

The conditions under which examinations will be held are as follows:—The City and Guilds of London Institute will afford facilities for carrying out an examination in any of the subjects, wherever a class for instruction is formed, or a sufficient number of candidates present themselves, provided a local committee undertake to carry out the examination according to the rules laid down.

The committee of any Art or Science School under the Science and Art Department, or any School Board, or any "Local Examination Board" connected with the Society of Arts, will be accepted as a suitable committee for carrying on the Institute's Examinations. In special cases, also, the Committee of the Institute may entertain propositions for the establishment of Special Local Committees for the Technological Examinations.

The Examinations will be in three Grades:—

I.—Honours
II.—Advanced.
III.—Elementary.

Grade I. is intended principally for foremen, overlookers, etc.; Grade II. for workmen; Grade III. for apprentices; but candidates may enter themselves for any grade they choose. Certificates (First and Second Class) will be awarded in each grade. Candidates who have taken a certificate may be again examined for one of a higher grade or class in another year.

Any person desiring to be examined, may present himself, but before he can take a certificate in Technology, he will be required to have passed the Science and Art Department Examination in certain science subjects. The science subjects required for each technological subject are given in the syllabus of each subject. Candidates who have previously passed the required science subjects will receive a full technological certificate on passing the examination in technology. Candidates who pass in technology alone will receive a preliminary certificate which will be exchanged for the full certificate whenever the candidate passes in science. There is no limit of age. Intending candidates should apply to the Secretary of the nearest Local Committee, who will forward their names to the Central Office in London, and through whom all information will be furnished. It is only in the case of candidates failing to make arrangements with the Local Secretary that any application can be considered by the Central Office.

The examinations are conducted by means of printed papers, and the answers are written upon paper specially provided for the purpose. The papers are sent down in sealed envelopes to the Secretary of the Local Committee immediately before the day of the examination, and the envelope containing the papers is opened by a member of the Committee, in the presence of each candidate, and he is known to the examiner only by that number. The worked papers are sealed up at once, and despatched to the office of the Institute. The certificates and prizes will be forwarded to the Local Secretaries as soon after the examination as possible. No application on the part of any of the candidates is therefore necessary.

The examination for the year 1880 will be held in May, on the same evening as is fixed for the examination in nautical astronomy by the Science and Art Department.

The following prizes will be given in each subject:—

Honours
1st Prize.—£5 and a silver medal.
2nd ,, £5 and a bronze ,,
3rd ,, A bronze medal.

Advanced
1st Prize.—£3 and a silver medal.
2nd ,, £3 and a bronze ,,
3rd ,, A bronze medal.

Elementary
1st Prize.—£2 and a silver medal.
2nd ,, £2 and a bronze ,,
3rd ,, A bronze medal.

No first prize will be awarded to any candidate obtaining less than 85 per cent. of the full marks, and no prize to any candidate who does not take a first-class certificate.

The following gentlemen have been selected to act as examiners for the two subjects in which our readers are especially interested:—

Gold and silversmith's works—James Garrard, Esq., (syllabus not published yet).

Watch and clock making—Edward Rigg, Esq., M.A.

The examination in watch and clock making will include questions founded on such subjects as the following, but will not necessarily be confined to these subjects:—

1. Mechanical and physical principles that have a bearing on watch and clock making—

Force, power, resistance, velocity, inclined plane, lever, resolution of forces, laws of falling bodies, inertia, momentum, percussion, volume, mass, density, weight, friction, adhesion, moment of inertia, centre and radius of percussion, radius of gyration.

2. The selection of metals for use in horological mechanism; characteristic properties of metals that determine their adaptability to different uses; hardening and tempering

3. Prime movers; weights and springs; means of rendering motive force uniform; stopworks and maintaining powers; remontoirs.

4. Depths; conditions of uniform lead; calculation of number of revolutions and vibrations per hour; trains of clocks and watches.

5. Forms of teeth; epicycloidal and involute teeth; relative dimensions of wheels and pinions in a given train.

6. Principles of action of the several escapements in common use, with conditions to be satisfied for efficient timekeeping. The cylinder, lever, and chronometer escapements, with some account of the advantages of each; pin and gravity escapements for clocks; detached and undetached escapements.

7. Simple and compound pendulums; law of their movement; relation of length to period of oscillation; conical pendulum; conditions of isochronism.

8. Annular balance and balance-spring; conditions of isochronism.

9. Theory of compensation in pendulums; considerations that guide in the selection of a pendulum; barometric error in clocks.

10. Compensation in watches and chronometers; action of ordinary compensation balance and source of error at the middle temperature; general principles on which it has been proposed to correct this error; mode of adjusting compensation; tabulation of errors.

For the full technological certificate, the candidate will be required to have passed at least in the elementary stage of one of the following science subjects:—

Machine Construction and Drawing.
Theoretical Mechanics.
Applied Mechanics.

We specially call the attention of intending candidates to the fact that they have a full and most reliable guide for their studies in Saunier's well-known "Treatise on Modern Horology," the English translation of which is now nearly complete, thanks to the able and patient labours of Messrs. E. Rigg and J. Tripplin. A careful study of this valuable work will enable any intelligent candidate to pass a creditable examination.

CORRESPONDENCE.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Dear Sir,—I think with you that a British Watchmakers' Society would be a great boon to the trade. You speak in this month's number of your valuable journal of the society in Germany. If the thing could be brought forward, I think myself that English watchmakers could not help seeing the advantages to be derived from it. I find that travellers in drapery, groceries, leather, &c., have agencies, and carry two or three watches with them, and introduce them to their customers at prices that we, who have only watchmaking to depend upon, cannot possibly sell at, and people will sooner buy of them, because they think they are getting a bargain. I think there is no trade more cut up than the watchmakers'; perhaps one reason is that samples of watches are so easily carried. Anything I could do to further and support a society for the protection of our trade I assure you would be done. I enclose my card willingly.

Yours respectfully,
October 8th. Ch. A.

Mr. Thomas Bragg, senior partner of the well-known firm of Messrs. T. and J. Bragg, goldsmiths and jewellers, of Victoria Street, Birmingham, died suddenly on the 7th ult. Mr. Bragg had just completed his sixtieth year. In him the Birmingham jewellery trade has undoubtedly lost one of its worthiest members.

"There has lately been a noticeable amount of emigration," says the *Coventry Herald and Free Press*, "from Coventry to various parts of the world. Australia, New Zealand, and the United States have all received their share, and the movement is still proceeding. The emigrants are of course of various occupations. but amongst them watchmakers are conspicuous. It is believed by some that there is a hopeful future for the watch trade in Australia, and at any rate it is clear that just now the industry is not flourishing in Coventry. Other things, however, being equal, it might be presumed that better times are coming. Watch manufacturers have generally done well when the iron trades were prosperous, and the improvement recently reported from the principal iron centres has suffered no abatement; the reports in Monday's *Times* show it to be continuing. As a result of the commercial revival in trade the watch trade in that country is at present very active. The natural result of this will be to lessen American competition away from home, as of course the Americans will give first attention to the home market. In this way, if in no other, it may be hoped the English trade will benefit."

Prices Current for Gold and Silver.—Value given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver, 4s. 6½d. to 4s. 9d. (variable according to quantity).

THE

Watchmaker, Jeweller, & Silversmith,

A MONTHLY TRADE JOURNAL,

Devoted to the interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades; published at Milner's Buildings, Moorgate Street (Opposite Moorgate Street Station), London, E.C. Booksellers and Newsagents supplied by Messrs. Catty & Co., 12, Ave Maria Lane, Paternoster Row, E.C.

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Mr. H. Bush, 14, Mytongate, Hull.

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Cheques and Post-office Orders to be made payable to A. Victor, at Lombard Street Post Office.

SPECIAL NOTICE.

All Remittances should be made by Post-office Orders.

Remittances by Cash or Stamps are entirely at the Sender's risk, and very objectionable.

Mr. J. H. Johns is the only authorised traveller for this Journal.

Receipts for subscriptions will only be sent when asked for, and on receipt of postage stamp for such purpose.

PATENTS.

Applications for Letters Patent.

4270. James White, of Glasgow, in the county of Lanark, North Britain, Optician, for an invention of "Improvements in spectacles and eye-glasses."—Dated 21st October, 1879.

Grant of Provisional Protection for Six Months.

3863. To Auguste Lion, of Paris, in the republic of France, Jeweller, for the invention of "Improvements in articles of jewellery having a scale-like appearance, and in the manufacture thereof, specially applicable to bracelets, necklaces, chains, and other such like articles."

3593. To Charles Feis, of Bartlett's Buildings, in the city of London, Watch Manufacturer and Importer, for the invention of "Improvements in Watches."—A communication to him from abroad by Messrs. August Vuille and Fils, of Chaux-de-Fonds, in Switzerland, Watch Manufacturers.

Patents which have become Void.

3970. Robert Kemp, of the firm of R. and J. Beck, of Lister Works, Holloway, in the county of Middlesex, and of Cornhill, in the city of London, for an invention of "Improvements in microscopes."—Dated 13th October, 1876.

3973. Charles Payne and Peter Steel, both of the city of Manchester, in the county of Lancaster, for an invention of "A new or improved device or means for securing scarf pins, brooches, and other descriptions of jewellery."—Dated 14th October, 1876.

3785. George Edward Pritchett, of 39, Lombard Street, in the city of London, Architect, for an invention of "New or improved means, apparatus, or appliances for utilising clocks, clockwork, or time-keeping movements, so as to put the same in communication with distant buildings, rooms, ships, mines, or places."—Dated 28th September, 1876.

Patents Granted in Foreign States.

United States of America.

217,861. William W. Covell, of Providence, R.I., assignor to Frederick I. Marcy, of the same place, for "The manufacture of wire fastenings for jewelry."—Application filed 21st April, 1879.

217,883. Gustavus Lenau and Edward Bent, of North Attleborough, Mass., for "Scarf-rings."—Application filed 25th June, 1879.

218,009. Rufus Folsom, of Boston, Mass., assignor of one-half of his right to Samuel Myers, of the same place, for "Watches."—Application filed 9th June, 1879.

218,368. John Dittmeier, of Rochestor, N.Y., for "Clocks."—Application filed 7th June, 1879.

218,556. Charles S. Moseley and Abraham Bitner, of Lancaster, Pa., for "Safety-pinions for watches and clocks."

218,613. William H. Zinn and Major D. Porter, of Boston, Mass., for "Watch-winding devices."—Application filed 19th May, 1879.

218,945. John Dittmeier, of Rochester, N.Y., for "Clocks."—Application filed 21st June, 1879.

218,980. Joshua M. Josias, of New York, N.Y., for "Clocks."—Application filed 23rd January, 1879.

219,008. John Obrig, of Newark, N.J., for "The manufacture of jewelry."—Application filed 18th April, 1879.

219,081. Leroy W. Fairchild, of New York, N.Y., for "A combined watch-chain bar and pencil."—Application filed 16th July, 1879.

219,097. William Wheeler Hubbell, of Washington, D.C., for "Alloys for jewelry."—Application filed 7th April, 1879.

219,202. Christian Blancard, of Jersey city Heights, N.J., for "Dies for manufacturing jewellers' settings."—Application filed 19th May, 1879.

219,226. Walter D. Davies, of Ansonia, Conn., assignor to himself and Henry J. Davies, of Brooklyn, N.Y., for "Back-actions for striking-movements of clocks."—Application filed 7th January, 1879.

219,293. Frank J. Noechel, of Rochester, N.Y., for "Machines for grinding spectacle-glasses, etc."—Application filed 9th January, 1879.

219,445. Solomon Coleman, of Taxing District of Memphis, Tenn., for "Jewelry-charms."—Application filed 21st April, 1879.

219,593. Theodore Mueller, of Philadelphia, Pa., assignor to Thomas B. Hagstoz and Charles N. Thorpe, of the same place, for "The manufacture of bezels of watch-cases."—Application filed 17th April, 1879.

219,595. Theodore Mueller, of Philadelphia, Pa., assignor to Thomas B. Hagstoz and Charles N. Thorpe, of the same place, for "Modes of manufacturing the pendants of watches."—Application filed 20th November, 1878.

219,642. William L. Martin, of Middletown, Conn., assignor of one-half of his right to George I. Russell, of the same place, for "Jewel-caskets."—Application filed 17th June, 1879.

219,646. Andrew M. Murray and Edward Bent, of North Attleborough, Mass., for "Methods of manufacturing plated stock for jewelry."—Application filed 1st August, 1879.

219,975. Casimir H. Bisson, of Henderson, Minn., for "Pendants for watch-cases."—Application filed 10th March, 1879.

German Empire.

7510. J. Walzer, of Reconvilliers (Switzerland), for "Improvements in watches."—Dated 15th May, 1879.—Class 83.

France.

129,722. Bernadac, of Paris, for "Range opera-glasses."—Dated 22nd March, 1879.—Class 12.

129,877. Gault, for "An apparatus for prolonging the movement of clocks."—Dated 29th March, 1879.—Class 12.

116,915. Brocot, for "A spring-suspension for clocks."—Dated 25th March, 1879.—Class 12.

Notices to Proceed.

2743. William Henry Read, of White Street, Coventry, in the county of Warwick, has given notice in respect of the invention of "Improvements in keyless watches."

2490. Jacob Merzbach, of Holborn Viaduct, in the city of London, has given notice in respect of the invention of "An improved clock movement."—A communication to him from abroad by Oreste Blanchetti, of Paris, France.

3055. Jacob Merzbach, of Holborn Viaduct, in the city of London, has given notice in respect of the invention of "An improved calendar clock movement."—A communication to him from abroad by Erhardt Junghans and Arthur Junghans, both of Schramberg, Germany.

Patents Sealed.

1322. Antoine Léon Cornu, Watchmaker, of 3, Bennett Street, Fitzroy Square, in the county of Middlesex, for an invention of "Improvements in machinery for converting striking clocks into chime clocks."—Dated 3rd April, 1879.

1745. William Hardy, the younger, of Thistleton, in the county of Rutland, Farmer, for an invention of "Improvements in cases for jewels and other articles."—Dated 2nd May, 1879.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Adjudications of Bankruptcy.

Foad, Andrew Baker, St. Stephen's Street, Norwich, watchmaker and jeweller. Oct. 25. At C. C. Norwich, Nov. 10, at 12. Cooke, Reg.

Hearn, Wm., Stroud Green Road, jeweller. Sept. 25. Brougham, Reg.

Lumley, John, St. Martin's Road, Stockwell, jeweller. Sept. 22. Hazlitt, Reg.

Liquidations by Arrangement or Composition.

Fear, Daniel, Wine Street, Bristol, jeweller. Oct. 20. Stanley, Wasbroughs & Doggett, sols., Corn Street. Bristol.

Musker, Geo., trading as Musker & Co., South Castle Street, Liverpool, and Chester Road, Tue Brook, nautical instrument, watch and clock maker. Oct. 22. At Gibson, Bolland, and Jackson's, 10, South John Street, Liverpool, Nov. 10, at 2. T. H. N. Bartley, sol., South John Street, Liverpool.

McCausland, Andrew, Balloon Street, late Church Street, Manchester, showcase maker. J. Gardner, sol., Cooper Street, Manchester.

Wilks, George, Myddleton Place, late Lloyd's Row, Clerkenwell, watch case springer and cleaner, etc. Oct. 24. At Buchanan & Rogers, sols., 10, Basinghall Street, Nov. 17, at 2.

Dold, Anton, Victoria Street North, Great Grimsby, jeweller. Oct 3. Grange and Wintringham, sols., Great Grimsby.

Foad, Andrew Baker, St. Stephen's Street, Norwich, watchmaker. Oct. 1. E. A. Tillett, sol., Norwich.

Jones, John, St. Peter's Street, Mile End, dealer in watch materials. Oct. 1. T. Whitwell, sol., 15, King Street, Cheapside.

Doly, Anton, Victoria Street North, Great Grimsby, jeweller. Oct. 3. Grange & Wintringham, sols., Great Grimsby.

Griffiths, Henry, Unett Street, and New John Street West, Birmingham, gold plate and gilt jeweller. Oct. 14. E. Jaques, sol., Temple Row, Birmingham.

Ham, Septimus Thomas, Farnborough, watchmaker and jeweller. Oct. 14. J. F. Terry, sol., King Street, Cheapside.

Meetings.

David, Herman & Leon David (Bkt.), Ely Place, London, and Northampton Street, Birmingham, diamond merchants. At Inns of Court Hotel, Lincoln's Inn Fields, Nov. 11, at 2. Consider offer of composition of 2/-, annul the bankruptcy.

Last Day for Lodging Claims.

Ryley, John (Liq.), Earlsdon, near Coventry, and Coventry, watch manufacturer. Claims by Nov. 8, to H. Suffolk, Coventry, accountant.

Dividends.

Payne, William (Liq.), Queen Victoria Street, and Highbury New Park, jeweller. Final div., 1d.; Wednesday next, and two following Wednesdays. S. B. Webber & M. Banes, at Sten & Knight's, 22, Basinghall Street.

Trustees Appointed.

Canadine Wm. (Liq.), Parkgate, Yorks., jeweller. Tr., J. C. Stephens, Rotherham, and J. S. Bartlett, Sheffield, accountants.

Harrington, Walter M. (Liq.), Dartford, watchmaker. Tr., J. Seear, Holborn Viaduct, accountant.

Swiss papers state that Neuchatel watch manufacturers have heavy orders for the United States in hand.

A 93¾ carat diamond, found recently at Mekerk's Bush, in the South African Diamond Fields, was sold on the spot for £7,000. The same digger to whose lot this rare find fell, unearthed about the same time a fine stone of 26 carats, and another of 10¾ carats, besides several smaller gems.

An innkeeper named Jean Coustade, at Eymet (Dordogne, France), was digging up the stump of an old oak tree a few weeks ago, whon his spade struck against a vase, which with its cover was shivered by the blow. The vessel was found to contain 600 silver pieces, each weighing upwards of 60 grains troy, and five gold coins of about 75 grains, all of them dating from the first century before the Christian era, their effigies being in a good state of preservation.

WHOLESALE AND EXPORT MANUFACTURERS AND IMPORTERS OF CLOCKS BRONZES, MUSICAL BOXES AND OPTICAL GOODS.

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All kinds of Full and Three-quarter Plate Movements in Hall-marked Gold and Silver Cases.

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CLOCKS AND OPTICAL GOODS.

HAVING had occasion to examine many excellent and extensive stocks of English and foreign time-pieces, we were under the impression that we had nothing new to see in that line, and that going over a clock manufacturer's and importer's establishment would simply be a repetition of pleasures often enjoyed before. With such a prospect before us, we entered that large and convenient building at the corner of Ely Place and Charterhouse Street, now in the occupation of Messrs. Geo. Bendon and Co. (late Keyzor and Bendon), who have removed to these more commodious premises from their old-established warehouse at 50, High Holborn. This firm has for many years justly enjoyed a high reputation among the trade, the result of constant and conscientious attention to the requirements of their extensive connection. For the benefit of those who are not already in business relations with this firm, and unacquainted with the high-class goods they supply, we beg to give a few particulars of the large and select stock offered here.

Immediately on entering, our illusion about having nothing more to see in the way of clocks was agreeably disturbed by a collection of time-pieces, the counterpart of which it would be difficult to find. Here our eyes met at once the best and most artistic that Paris and Clerkenwell can supply. These handsome time-pieces are most judiciously displayed, so as to afford ready inspection and comparison between the various styles; and we feel sure that even the most refined taste can be gratified in this establishment. We hardly knew which to admire most, the exquisite designs, or the skilful execution and rich finish of the work; and it must be rather embarrassing to make a choice among such gems of the clockmaker's art. It must be understood that this applies to their show-room on the ground-floor. Messrs. Bendon and Co., although they provide every grade of clocks, wisely allot the different kinds of stock to separate show-rooms; instead of destroying the pleasing effect produced in this department by the admixture of a quantity of common though useful wooden clocks and metal alarums, they have, on the contrary, enhanced it by calling in the aid of a splendid collection of bronzes, comprising groups for tops of clocks, and statuettes, equestrian figures, candelabra, and of China figures, Chinese and Japanese pottery suitable for side ornaments. This firm makes the importation of Chinese and Japanese ornaments, of superior quality only, a speciality, and we do not think that they can be obtained from any other house in this branch.

The first-floor is also taken up by clocks, and the same excellent arrangement prevails here as on the ground-floor. An immense variety of marble, bronze, ormolu, and alabaster clocks, etc., meets the gaze of the visitor in every direction, including numerous new designs and ideas; and our readers would find a visit to this establishment most beneficial, as many most desirable additions to stock are offered here. Messrs. Bendon and Co. show a number of very attractive specialities in combinations of barometers with timekeepers; one of these, a clock and aneroïd, suitably connected by a thermometer, with a compass on its top, deserves particular notice; this is a very tasteful article in nickel, and must command a ready sale. We were also shown a neat and cheap little time-piece, with first-class cylinder movement, in ebonized woodcase with nickel handle. This firm has the exclusive sale of this clock, and large quantities are being sold; the trade will certainly find this a very current article. We must also mention a large assortment of regulators, many of them in unusually handsome cases.

The next floor is devoted to optical goods, mathematical instruments, etc., but the space at our command will not permit us to give more than an enumeration of some of their leading goods in this department. Every description of spectacles, eye-glasses, telescopes, microscopes, stereoscopes, marine, field and opera-glasses, mathematical and surveying instruments, quadrants and sextants, compasses, barometers, thermometers, and a host of other things belonging to the same branch, are supplied by Messrs. Bendon and Co.; the goods are of first-class makers only, and at prices which enable them to compete successfully with any other firm in the same line.

The top floor of the warehouse contains a vast reserve stock of their miscellaneous manufactures and importations, and here we find also a staff of competent workmen, engaged in examining ordered goods previous to delivery. Our visit to this establishment has certainly afforded us pleasure and instruction, and we have no doubt that intending purchasers would derive profit as well from a similar visit.

From experiments made by Mr. J. T. Bottomley, it seems that the prolonged application of stress has a very remarkable effect in increasing the strength of soft iron wire. He read a paper on the subject before the British Association at Sheffield.

Jacob Reese, of Pittsburgh, Pa., claims to have discovered a process of fusing metals without fire. He asserts that he is able to melt instantly a bar of cast steel one inch in diameter—which cannot be fused in less than five minutes in the highest furnace heat attainable—simply by throwing against it a column of air having a velocity of 25,000 feet a minute. The instant the air touches the metal, fusion takes place.

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THE WATCHMAKER AND SILVERSMITH'S JEWELLER. TRADE JOURNAL.

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

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CONTENTS.

	PAGE		PAGE		PAGE
Horology	69	Trade Recipes, &c.	73	Diamonds	78
Correspondence	70	Jewellery Cases, &c.	73	Jewellery in Relation to Art..	79
Practical Instructions to Jewellers, Silversmiths and Electro-platers	71	Curiosities of Clocks and Watches	74	Patents	80
Queries and Answers	71	Hints to Repairers	75	Monthly Record of Bankruptcies	81
Foreign Horological Literature	71	English Watch Company	75	Antique Coin Jewellery	82
Bronzes	72	On the Demagnetisation of Watches ..	76	Directory	ii
		Handsome Piece of Goldsmiths' Work ..	77	Advertisements	i-x

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HOROLOGY.

(*Continued from page 56.*)

XLVII.—Centre of Oscillation.

THE facility with which compensation pendulums are invented seems to indicate that many young watchmakers, and perhaps some not so young, have not a clear comprehension of what is exactly meant by centre of oscillation in a pendulum. The centre of gravity they easily understand, because it is easily found by experiment, and is easily explained without experiment, as being the point upon which the pendulum, as a whole, would be poised; but fail to comprehend why the centre of oscillation should not be at the same point. Perhaps the following explanations may help to elucidate the mystery.

All know that a simple theoretical pendulum is one where the whole weight is centred in one point, suspended from, and oscillating about, a fixed point, or centre of suspension. A sphere of platinum, suspended by a fibre of silk, would probably be the nearest approximation to a perfectly simple pendulum. A compound pendulum is one where the weight is not centred in or about one point, but is extended for some distance up and down the rod. Suppose there are fixed upon the fibre, at equal distances, three platinum balls. From the well-known fact that a short pendulum vibrates quicker than a long one, the upper or short pendulum will *endeavour* to make its vibrations in the short time due to its length as a pendulum. The middle ball will *endeavour* to make its oscillations in the time its length of support demands, and the lower and longest will attempt the slow and regular vibrations of the long pendulum. Suppose that these three balls, representing three pendulums of three different lengths, be drawn aside from the perpendicular 5°, and suddenly released, the consequence will be that the upper one will have made its full excursion by the time the middle one has descended to the perpendicular, and before the lower one has arrived there; the momentum of the three balls bending the fibre of silk into such a curve as will accommodate the *tendencies* of the three balls.

If the silk fibre be replaced by an inflexible rod, and the now rigid compound pendulum be drawn aside as before, the upper ball will *endeavour* to hasten forward the middle one to its own speed, and the middle one and upper one will both combine to hasten the lower one. So also the middle one will retard somewhat the rapidity of the upper one, and the slow-moving lower one will do its best to restrain the haste of both those above it, and the consequence of all these tendencies will be that the lower one will be somewhat accelerated, and the upper one proportionally retarded; the whole assuming a vibration which is the mean (middle ball) of the two extremes, provided the three masses are equal, thus compelling the whole to oscillate as a pendulum whose length is that of the middle ball. But if the lower ball be the largest, its control over those parts above it will be in proportion to its mass, and the time of its vibrations will nearly coincide with those made by its centre of gravity.

Suppose, again, the largest amount of matter to be in the upper ball. Then will its influence be more potent towards forcing the lower and longer pendulums to accommodate their rate to that of the upper one, and their vibrations will be thereby increased to a degree which will approximate the normal vibrations of that short pendulum. Thus you see the difficulty of accurately fixing upon the exact length of any compound pendulum by simple computation. Every particle of matter from the top of the rod to the lower extremity, which differs in its distance from the point of suspension, has its own time for making an oscillation about that point; and the greater the number of particles that have an equal distance from that point, the greater influence they possess in determining the time of vibration; in this case, as in republics, the mass rules. To obviate these counteracting influences that are constantly at work in the oscillations of the compound pendulum, it becomes necessary to concentrate, as far as possible, all the matter of the pendulum at such a distance from the point of suspension as will produce the number of vibrations desired, and this centre of oscillation will always fall in a line produced through the centre of gravity and the point of suspension, and will always be below the centre of gravity.

The centre of oscillation and suspension are convertible points; that is, a pendulum inserted and suspended from the centre of oscillation will vibrate in the same time. Huyghens discovered this remarkable fact, and it affords a ready means of determining experimentally the length of a compound pendulum, which may be measured by means of a platinum or lead ball, suspended from a fibre of silk from the same point, and in front of the pendulum to be measured, and of such a length that the vibrations will perfectly coincide in time. The distance from the point of suspension to the centre of the ball (which is also the centre of oscillation) is very nearly the length of that compound pendulum.

It should be remembered that the *centre of oscillation* is the point to be affected in all compensations for temperature. The difficulty in producing a perfect compensation pendulum is, to harmonise and bring into coincidence the antagonistic tendencies of the centre of gravity, centre of oscillation, and moment of inertia, all of which are properties and peculiarities of compound pendulums, and must be taken into consideration by those who are experimenting upon them with the expectation of producing any arrangement in advance of those in use at present.

(*To be continued.*)

An extraordinary robbery was, on Saturday, the 15th ult., made known to the police authorities at Bow Street, London. It appears that on Friday night a gentleman, a member of a large firm of diamond merchants, of Bois-le-Duc, Holland, and staying at the Charing Cross Hotel, after doing business with a firm in Hatton Garden, was returning to the hotel between 9 and 10 o'clock. When passing through a street out of Holborn, he states that he became faint and sat upon a doorstep. On recovering he found that his watch and chain were gone, as well as a small leather bag, containing a large quantity of precious stones, which he values at £26,000, there being no fewer than 98 uncut Waterkloof diamonds, weighing from two to ten carats, and all of great brilliancy and lustre, besides emeralds, pearls, rubies, and sapphires. A reward of £1,000 is offered for the recovery of the property.

CORRESPONDENCE.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Dear Sir,—Availing myself of the opportunity, I cannot omit to offer my feeble response to the well-meant and timely suggestion of "Ch. A." in the last issue of this journal concerning establishing a Watchmakers' Society in Great Britain. The advantages to be derived therefrom would be mutual to the members of the trade and beneficial to all.

United Watchmakers' and Jewellers' Societies in the various towns could soon devise means and ways to secure the local trade and put a stop to its being illegitimately wrested away by people who have not a shadow of right to it, and actually pursue their calling in an illegal manner. The evil is not confined to the selling trade only, but makes itself sadly felt in the line of repairing, as watchmakers and jewellers cannot be unaware of the numerous hawkers in all parts of the country who, by their importune habits unduly interfere with and injure the trade of the *working* watchmaker and jeweller by obtaining watches and jewellery from the public to be repaired, getting the work done at the lowest possible trade price, regardless of workmanlike execution, and thereby depriving the honest workman of what is legitimately belonging to him.

Your journal, so well-received by the watchmakers and jewellers in the various parts of the kingdom, would soon be able to rouse the members of the trade to the importance of founding societies in their midst, and devise rules and regulations for their maintenance. The cost is trifling, the advantages apparent, and the success to achieve them infallible.

Yours truly,
Hull, November 11th, 1879. H. B.

Technical Education.—A class for blow-pipe analysis, in connection with the City and Guilds of London Institute, commenced at the Quebec Institute, Baker Street, on Thursday, 13th ult.

The *World* calls attention to a novel kind of opera-glass. The central cylinder is enlarged and hollowed for the reception of choice old cognac; to this is attached a nozzle, which can be unscrewed, and a suction pipe inserted.

Imitation Diamonds.—False diamonds are now manufactured in Paris by a new process, which are said to possess the lustre, brilliancy, polish, and durability of real brilliants of the first water. It is asserted that jewellers and other authorities in gems cannot detect the imitations without some technical test. They are sold at about 1-500th the price of real brilliants.

The decline and resuscitation of the jet industry of the Cleveland district reflects on a small scale the ultimate triumph of solid worth over counterfeited virtues of which the moralist and the dramatist have so long been assured. For many years the jet trade of Whitby kept large numbers of miners employed on the cliffs in which the beautiful coal is found, and the industry seemed likely at one time to become of something more than local importance. Spain, however, produces a jet which, though neither so hard or so brilliant when polished, is much cheaper than the English article, and the very large importations made in recent years, combined, of course, with the general depression of trade, put an end to "jetting" in the Cleveland district. The stocks on hand at Whitby have been gradually exhausted, and the demand for something better than the friable and dull jet of Spain is now reviving the English industry. Honesty is the best policy, therefore, for minerals as well as for men.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. VIII.

(Continued from page 57.)

ANOTHER battery used by the electro-gilders of watch parts, and by telegraphists, is composed of a cylindrical vase of stoneware, glass, or porcelain; a cylinder of zinc to which is soldered a ribbon of pure copper; a porous clay cell, and a glass balloon with a short neck, and filled with crystals of sulphate of copper. It is closed with a cork perforated with two holes, or having two notches cut along its sides. The rolled zinc plate is put into the stoneware pot, and the porous cell inside the zinc. The copper ribbon of the zinc of the first element dips into the bottom of the cell of the next element, in such a manner that, when several elements are connected together, there is at one end the ribbon of a zinc plate, and at the other end a copper ribbon put into the cell. Then the porous cell and the stoneware pot are filled to the same level with water. The balloon containing the crystallized sulphate of copper receives as much water as it can hold, and the notched cork being put in place, the balloon is quickly inverted with its neck in the water of the porous cell. The battery is ready to work twenty-four hours after. The ribbon of the zinc end is connected with the objects to be electroplated, and that of the other cell end, with the soluble anode. The sulphate of copper contained in the balloon is dissolved in the water around it, and as this solution is denser than water, it falls into the porous cells through one of the notches of the cork, while an equal quantity of purer and lighter water ascends through the other notch and so on, producing a circuit of denser liquor falling by one notch, and of lighter liquor rising by the other. The solution of sulphate of copper is decomposed in the porous cell; the sulphuric acid passes through the cell by outward pressure and acts upon the zinc, and at the same time the copper becomes deposited upon the copper ribbon connected with the zinc of the former element. In order that this battery may work regularly for six or seven months, it is sufficient to replace the evaporated water. The balloon ought to contain at least 2 lbs. of sulphate of copper, and the zinc to be about 7 inches in height, and from 4 to 4½ inches in diameter. The zinc may be amalgamated, in which case the action is a little slow at the start, but more regular afterwards. The copper ribbon receives all the metal of the decomposed sulphate, and it sometimes happens that part of the copper becomes deposited upon the porous cell, which must then be cleaned in aquafortis. When all the sulphate of copper is used up, the balloons are filled with a fresh quantity of crystals, and new copper ribbons inserted to take the place of those rendered too bulky. If it be desired to start the battery with a balloon immediately, add a small quantity of sulphuric acid or of common salt, to the water in which the zinc is placed.

Bunsen's Battery.—Each element is composed of a glass vessel which is half filled with nitric acid at 36° or 40° Baumé, and which receives a hollow cylinder of pulverised coke, moulded and cemented at a high temperature by sugar, gum, tar, or some analogous substance. The upper part of this cylinder, which does not dip into the glass vessel, carries a copper collar, which may be tightened at will by means of a screw. A copper band or ribbon is fixed to the collar, and may be connected with the zinc of another element. A porous porcelain cell is placed inside the coke cylinder, and contains a diluted solution of sulphuric acid, one part acid and nine parts water, into which is put a bar or cylinder of zinc strongly amalgamated or covered with mercury. When a battery of several elements is to be formed, the coke of the first element is connected with the zinc of the second, and so on, and the apparatus is completed, at one end, by coke communicating with the anode, and at the other by a zinc connected with the cathode, or object to be electro-plated. In this apparatus the surface of the carbon is much greater than that of zinc; this is a wrong disposition, since, generally, the intensity of the current is in direct ratio with the surface of the zinc corroded, provided that this surface be opposite and parallel to that of the carbon.

Bunsen's Battery Modified by Archereau.—This battery is preferred by gold and silver electro-platers. Each element is composed of an exterior vessel or pot, most generally of stoneware; a cylinder of zinc covered with mercury, provided with a binding screw or with a copper band, whether for a single element or for the end of a combination of elements in a battery, or to connect the zinc with the carbon of another element, a porous cell of earthenware pipe or porcelain, a cylinder of graphite, made from the residue found in old gas retorts. The graphite is bound by a copper band, fixed to it by means of a wire of the same metal, all the binding being afterwards covered with a thick varnish to protect it from the acid fumes of the battery; notwithstanding the varnish, the acid may rise by capillay attraction and corrode the copper band between the carbon and the wire; therefore binding screws of various shapes and sizes should be used to connect the carbon or zinc by means of ribbons or wires. Use conducting wires of pure copper, covered with cotton, silk, india-rubber, or gutta-percha, and presenting the metal at their extremities in order to effect the connections.

(To be continued.)

QUERIES AND ANSWERS.

Bath for Electroplating.—What shall I use to contain electroplating solution? Would "Valencia slate" or "lead" be suitable? Is not slate too porous and lead liable to the action of the cyanide, or would the cement (for slate) or solder (for lead) used in making the joints, be liable to the action of the solution? I want a large square bath to do candlesticks, teapots, salvers, etc.; therefore the brown crock which I use is too small and a bad shape. What do they use in the trade?—R. H. Thomas, Fermoy.

FOREIGN HOROLOGICAL LITERATURE.

German literature on Watchmaking has of late been enriched by several good publications, viz:—

"Allgemeines Lehrbuch der Uhrmacherkunst." With lithographic plates. By A. Johann, Watchmaker.

"Leitfaden für Uhrmacher-Lehrlinge." Prize-Essay of the German Watchmakers' Association. By H. Sievert, Watchmaker.

"Praktisches Handbuch für Uhrmacher." With map of well executed engravings. By H. Grosch, Court Watchmaker.

"Dritter Jahrgang des Notizkalenders für Uhrmacher." With good engravings. By M. Grossmann, Watch Manufacturer.

Prospectuses of the above, and every information, of the publisher's agent, H. Bush, Hull.

BRONZES.

By C. D. E. Fortnum, F.S.A.

(Continued from page 58.)

Of the wonderful excellence to which sculpture had been brought in every variety of material in its largest conception and in its most minute detail, some small idea may be formed from the fact that the celebrated "Venus of Milo" (now in the Louvre), perhaps one of the grandest impersonations that has been preserved to us, is considered by some connoisseurs to be only a carefully executed copy. More probably, however, it is really an original work of that time although not celebrated in antiquity. To this period may possibly also be assigned the beautiful bronze head of Aphrodite, found in Thessaly, now in the British Museum; an original work of the highest excellence.

The influence of so great a mind as that of Pheidias spread far and wide, more or less modifying the schools of sculpture existing in the other states of Greece, the Archipelago, and her colonies, winning them by the magic charm of his artistic power to acknowledge the superiority of the Attic school. In the Peloponnesus, Polycleitus, the fellow-pupil of Pheidias, had established an important school at Argos. In this, what may be deemed a naturalistic tendency prevailed. As we know that history repeats itself in art as in politics and war, so here, also, we find the prototypes of these two great divisions under which the artists of the Italian *renaissance* may also be classed.

But we are told of the art of Polycleitus that, although the ideal was rendered by him subservient to natural beauty, nature herself was almost surpassed by the exquisite physical creations of his chisel; his colossal statue of Hera, a toreutic work erected at Argos, was important for size and excellence. Another, the statue of a beautiful youth, must have been the perfection of nascent manhood. We can hardly judge of the merits of this bronze from the antique marble supposed to be a copy, which is now preserved in the British Museum. In the Braccio nuovo of the Vatican is a figure of an amazon, also believed to be an antique copy after a work by this great master. We cannot here specify other lost works recorded as the productions of his skilful hand, which delighted in the most minute and careful execution of every detail. He is said to have been the first sculptor who dared to adopt the system of throwing the whole weight of a figure upon one foot, leaving the other free or even detached from the base; a conception whereby a great effect of lightness and elasticity was obtained, but which could only have emanated from an artist habitually working in metal rather than in marble.

It was about this time when the female form was represented in perfect nudity more frequently than had been the custom of a former age; we know that Pheidias had modelled Venus a nude, in the Pantheon, but this was an exception rather than the rule. Such was the crouching figure of Venus by Daedalus which, according to Pliny, was in the portico of Octavia. The well-known marble figures in Florence, in the Vatican, and elsewhere, are looked upon as ancient copies of this work. Meanwhile in Athens Cephisodotus (the elder), supposed to be the father of Praxiteles, was carrying out a style which, while partaking largely of the purely ideal sentiment of the school of Pheidias, had yet a tendency rather towards a more realistic treatment. He also worked in bronze, producing statues of the gods; of which one, a Minerva at the Peiræus, is referred to by Pliny in terms of praise, as also an altar in the temple of Jupiter Soter.

From the heart-stirrings and universal commotion of the Peloponnesian war sculpture received another inspiration, that of mental emotion and unrest, as contrasted with the sublime repose and dignity of the earlier Attic school. Greece was fatally divided against herself, and individual aggrandisement prevailed over self-sacrifice for the public good. Art became personal to states or individuals rather than the expression of a national devotion and of a high religious sentiment. Wealth and luxury had increased, and with them came a loosening of the Spartan spirit of a more primitive age. The commencement of a sensational and subjective epoch had been reached, and softer forms of female beauty were contrasted with a somewhat excessive and passionate emotion or of a dreamy and affected repose in the male, as also indeed in many of the female figures.

Scopas, Timotheus, and Leochares were leading artists of this time. Praxiteles was another great citizen of Athens, where he was born about 390 or 392 B.C. He is said to have worked by preference in marble as a more favourable material for the display of his unrivalled power of representing female and youthful beauty. In this he attained to the highest excellence in his nude statue of Venus at Cnidus, which called forth the rapturous admiration of the classic world, and was copied in the Cnidian coins. He nevertheless occasionally made use of bronze, but of some fifty works spoken of as by him the greater number are in the lighter material. The original of the well-known faun of Praxiteles was probably of bronze.

Cephisodotus and Timarchus, sons of the great master, also worked in bronze. To this period's school may probably be assigned the elegant figure of a youth listening, so well known as one of the choicest bronzes which Pompeii has afforded (in 1865) and which graces the Neapolitan museum. Silanion executed portraits in this material, as did also Euphranor, the painter and sculptor, a man of universal artistic genius. Among the Peloponnesian artists at the same time Lysippus must first be named, who from his youth was accustomed to work in bronze, a material which he constantly employed. He soon obtained not only the patronage of Alexander, but the exclusive privilege of portraying him in sculpture. His works were very numerous, nor need we specify more than a few of the more remarkable; the colossal Jupiter at Tarentum, said to have been sixty feet in height; a group of Apollo and Mercury disputing for the lyre; and the Helios in his chariot at Rhodes, the effect of which Nero subsequently impaired by gilding, which had to be removed. The fine marble in the Vatican of an athlete using the strigil upon the extended right arm would seem to be an ancient copy from the bronze original, ascribed to Lysippus, which formerly was placed in front of the Thermæ of Agrippa at Rome. The seated bronze Mercury at Naples, found at Herculaneum, is of his period and school, and possibly from the hand of the master himself. Pliny tells us that Lysippus produced not less than fifteen hundred statues by his own hand, a number, even including statuettes, which would seem to be incredible.

(To be continued.)

According to the *Journal Suisse d'Horlogerie*, the watchmaking industry of the canton of Neuchâtel is about 200 years old. The first watch was constructed in that part of Switzerland about 1680 by Daniel Jean Richard. In 1705 he settled in Locle, while workmen of his training established themselves in various other parts of the Jura.

Single-stone diamond gipsy rings are being offered in London, says the *Pawnbrokers' Gazette*, by a man about fifty, who says he has advanced £1 on it, and wanted to pledge it for £2 10s. The paste is a very good imitation, especially in daylight, and the mount is brass, with the 18-carat Hall mark.

TRADE RECIPES, &c.

Use of Petroleum in Turning Metals.—A bronze composed of 7 parts of copper, 4 of zinc, and 1 of tin, is so hard as to be difficult to work, and yet of considerable value in certain ways when worked. Various methods have been attempted, aiming at effecting a ready working of this alloy. Mr. Bechstein has lately attained this desirable end by soaking the alloy in petroleum.

To Clean Brass Inlaid Work.—Mix tripoli and linseed oil, and dip into it a rubber made of a piece of an old hat, with which polish the work, and rub off with clean soft leather. If the wood be ebony or rosewood, polish it with a little finely-powdered elder ashes; or make a paste of rotten-stone, a little starch, sweet oil, and oxalic acid, mixed with water. The ornaments of a French clock are, however, best cleaned with bread-crumb, carefully rubbed, so as not to spoil the wood-work. Ormolu candlesticks, lamps, and branches, may be cleaned with soap and water. They will bear more cleaning than lacquered articles, which are spoiled by frequent rubbing, or by acids or strong alkalies.

Improved Electric Amalgam.—It is well known that a deposit of moisture greatly interferes with the action of electrical machines, experiments often wholly failing from this cause, especially in winter. Mr. F. Dietlen, of Klagenfurt, Germany, has devised a method by which he obviates this difficulty, consisting simply in a modification of the amalgamation of the rubber-cushion. For this purpose he pours petroleum over zinc filings, and adds an equal quantity of mercury (though an excess of mercury facilitates the process). The mixture is then brought, by working together in a mortar, to the condition of a homogeneous paste, and pressed between a double cloth. A soft mass is thus obtained, which, however, soon hardens; but which, being finely pulverised and mixed with a proper quantity of grease, is spread upon the rubber-cushion. This makes the surface quite glossy, and, when the glass dish has previously been wiped with a piece of cotton slightly impregnated with petroleum or benzine, will develop electricity abundantly even in damp localities where the usual arrangement fails.

To Cover Articles of Zinc with Copper or Brass by One Immersion.—To give zinc a coat of copper or brass for the purpose of a subsequent silvering or gilding, the following solutions are used:—For copper alone, a solution of sulphate of copper, saturated at the common temperature, is mixed with a solution of cyanide of potassium, adding as much of the latter as is necessary to re-dissolve the precipitate thrown down at first. The prussic acid disengaged during this operation must be carried off by a draught or flue. When the mixture is clear, one-tenth, or one-fifth of its volume of water of ammonia is added, and then diluted with water to a density of 8° Baumé. For brass, sulphate of copper and sulphate of zinc are used in equal proportions, and prepared as before. Two parts sulphate of zinc and one of sulphate of copper give a bright brass coating. Previous to their dipping, the articles of zinc are rubbed off thoroughly with finely-powdered pumice-stone and rinsed in water, after which they are placed in the bath, and remain there for twenty-four hours. After that time they are again mixed in water and simply wiped. The copper or brass covering has a very bright look, as if polished, and adheres perfectly. The thickness of the coat may be increased afterwards by the aid of a battery.

(To be continued.)

Paris and its surrounding districts manufacture more than a million springs annually, and consume about 80,000 kilos of steel in their production. Three-fourths of these springs are exported to England, America, and Germany; Holland, Italy, Spain, and France, use the remainder.

JEWELLERY CASES, ETC.

THE shopkeeper knows very well that a good deal of his success depends upon the manner in which he can display his goods to the customer, and that there are means at his command which enable him to enhance the effect of articles of jewellery; he knows also that the manufacturer of jewel cases, and other jewellers' requisites is ever striving to produce something which will aid him in setting off his goods and attract purchasers.

We lately visited the well-known factory of Mr. George F. Hewitt, of 37, and 38, Augusta Street, Birmingham, where all kinds of jewellery cases, velvet stands, glass show cases, spectacle cases, trays, cardboard boxes, and other sundries required by jewellers, are manufactured, and we can testify that the work in this establishment is turned out in first-class style.

A speciality of this firm are their Russian leather cases, which are certainly a vast improvement on the morocco ones; they look very superior, and the gilding being applied on a smooth surface, takes more effectively. A great advantage is that these cases never want varnishing.

Another novelty of this firm is a ring case, which recommends itself at once. It is covered with the best Utrecht velvet, and the division blocks, instead of being in wood, as is usual, are made of some more elastic material, so that any size rings can be inserted. The rings are held so firmly that the case can be turned about at will, without the risk of their falling out. The same principle is also applied to single ring cases.

We noticed also a decided improvement applied to what are known as horse-shoe ring cases. The card-board stock of the case, so liable to break, especially if a ring has to be forced in, is supplanted by a steel one, capable of standing any amount of pressure. The jewellers' rolls sold by this firm have also great advantages over the old ones; they are made of morocco leather, lined with chamois, and with proper usage will last a life-time. Goods sent to this establishment are cased without delay, by return post if desired, certainly a great convenience to the trade.

An International Exhibition of watches, musical boxes, gold and silver wares, etc., is to be held in Switzerland in 1881.

A few weeks ago, a jeweller of the Rue Rambuteau, Paris, was much surprised by a visit from a working man, who offered to sell him a splendid diamond ring, worth at least 10,000 francs, for the small sum of 400 francs. His suspicions being aroused by the divergence between the value of the trinket and the sum asked for by the would-be vendor, he communicated the matter to the Commissary of Police, who proceeded to the working-man's residence. On being told that the ring was worth 10,000 francs, the man evinced much unaffected astonishment, and said he could not understand how his sister could have sunk such a sum in a ring. Upon inquiry, it turned out that his sister had undoubtedly left him the ring upon her death, and that she had acted as lady's maid to the wife of a nobleman attached to a foreign embassy. This news gave the official a clue which he was not tardy in following up. Having presented himself at the diplomatist's residence, the wife of the latter at once recognised the ring as one that had mysteriously disappeared six years before. The upshot of the affair is, that the workman, who had acted throughout in good faith, and had stated that had he known the ring was not honestly his, he would have taken steps to return it, is rewarded by the rearing and education of his six children being taken in hand by the rightful owner of the jewel. Thus the matter ends happily for all parties. The lady unexpectedly recovers her lost diamond, and the workman's honesty is adequately rewarded.

CURIOSITIES OF CLOCKS AND WATCHES.

(*Continued from page* 60.)

In the museum of Cox was also the "Perpetual Motion," "a mechanical and philosophical timepiece." "From this piece," says its inventor, "by a union of mechanic and philosophic principles, a motion is obtained, which will continue for ever; and although the metals of steel and brass of which it is made must in time decay, still the primary cause of its motion being constant, and the friction upon every part extremely insignificant, it will continue its action for a longer duration than any mechanical performance has yet been made to do." This perpetual timekeeper differed but little from an ordinary clock, except that it was with diamonds jewelled in every part where the friction could be diminished. An old engraving by J. Lodge, represents "Mr. Cox's Perpetual Motion, a Prize in the Museum Lottery." It is somewhat like a tall eight-day clock, with the ordinary dial at the top; the sides and front of the case appear to be of glass, through which are seen some cumbersome pendulum work, and cords and pulleys. We might extract several other interesting descriptions of clockwork automata which were to be found in this unique collection: but if we were to do so we should be digressing from our subject, the curiosities of horology. It was said in praise of the possessor of this museum of mechanical wonders, by Mason, a contemporary poet:—

> "Great Cox, at his mechanicall,
> Bids orient pearls from golden dragons fall;
> Each little dragonet, with brazen grin,
> Gapes for the precious prize, and gulps it in.
> Yet, when we peep behind the scene,
> One master wheel directs the whole machine;
> The self same pearls, in nice gradation, all
> Around one common centre rise and fall."

In the "Gentleman's Magazine," for 1771, and the "Annual Register" for the same year, we read that an eminent jeweller of London had a clock of exquisite workmanship, which was designed for the Grand Signor. The case was of massy gold, finely embossed, overlaid with diamonds, some of them being as large as, or larger than, a guinea, and of the finest lustre. Pearls as big as birds' eggs hung on two gold enamelled trees, that grew out of the gold rock pedestal in which the clock stood. A tree was on each side, and their fruit were pearls. Two great emeralds as large as pears were fixed on the two front pillars, and the characters on the dial plate, which were Turkish, and the hands also, were of diamonds. This bejewelled horologe was in keeping with Eastern splendour, and might have struck the hours in an Arabian night's entertainment very fittingly.

On March 29th, 1772, Emanuel Swedenborg died. As he lay upon his death-bed, he heard a clock strike; he asked his landlady and her maid, who were both sitting at his bedside, what o'clock it was, and upon being answered, he said, "It is well—I thank you—God bless you," and then in a moment after he gently expired.

The church of St. Vincent de Paul at Paris has two clocks, one for telling the hour of the day, and the other, the days of the month. The Hotel de Ville clock, at this city, of which report speaks highly, was described in 1844 as being a thirty-hour clock, made by Lepaute in 1781, and costing, including the two dials, three bells, and fixings, ninety thousand francs. In all the large public clocks on the continent lantern pinions are used, and in the one at the Hotel de Ville they are pivoted into a frame similar to the pinions of Harrison's first chronometer. In this clock, although the curves on the wheel-teeth have no pretentions to mathematical accuracy, having been filed up by hand, there is not, after many years' performance, any appearance of wear, either in the face of the teeth, or in the pivot holes of the leaves. The weight of the first power is three hundred and fifty pounds. B. L. Vulliamy says:—"I was the first in this country to employ a two seconds pendulum (the clock at the Hotel de Ville at Paris is indeed the only clock on the Continent that I ever saw with one), or who applied a hand to indicate seconds, or a degree plate, by which to ascertain the arc of vibration of the pendulums, and, with few exceptions, to employ for a pendulum a wooden rod, a short suspension spring, and a very heavy bob. Previously to this the pendulum rods were almost invariably made of iron, with very long springs and light bobs." To compensate a two-seconds' pendulum is always attended with much inconvenience. The pendulum of the great clock at the Hotel de Ville is a two-seconds' one, with a nine-bar gridiron rod; and the great weight of the rod is a serious objection to it. Writing on the subject of clocks in France, Vulliamy condemns their style, or as their makers say, "luxe d'exécution"; and in reference to their pendulums he says: "No expense is spared in the pendulums of French clocks of a superior class, which are all what are termed gridiron pendulums, of various constructions, varying from five to nine bars, and in length from about five to seven or eight feet; consequently the clocks cannot indicate seconds in the ordinary mode; indeed, I did not notice a single clock of this description to which a seconds'-hand or index, or a degree-plate to indicate the arc of vibration of the pendulum, was supplied. The execution of these pendulums is certainly very beautiful; but the great weight of the rod in reference to the bob is a very serious error in principle, and, in my opinion, more than counterbalances any advantages they may be thought to possess."

In Turner's "History of Hertford" will be found an account of John Bryant, the bell-founder and clockmaker, who was born at Exning, in Suffolk. Although designed for holy orders, his love of mechanism was so strong that he was allowed to follow his natural bent. In both branches of his trade he attained to a pre-eminence which rarely has been acquired by an individual. As proofs of his skill in horology may be enumerated the clocks of the Dukes of Marlborough, Rutland, and Grafton; the Marquises of Exeter and Salisbury; the Earls of Hardwicke and Cowper; the Lords Montague and Breadalbane; together with the clock in the Town Hall of Hertford. Bryant died in 1829, aged eighty-one, and is buried at Hertford. His bells and clocks there bear various dates between the years 1782 and 1824.

William Kennedy, the celebrated blind mechanic, of Banbridge, County Down, Ireland, who died about the year 1790, actually made many clocks, both common and musical.

In the "Gentleman's Magazine" for 1807, is an engraving, from a drawing by T. Fisher, of a conduit of stone which stood in the middle of High Street, Maidstone, and was pulled down about the year 1793. It formed a kind of octagonal embattled tower, crowned with a clock and cupola.

(*To be continued.*)

Discovery of Sapphires in Siam.—There has recently been a great rush of Burmans and Shans across the frontier into Siam, attracted thither by a reported discovery of a great field of sapphires. Should these pioneers meet with success, we may depend upon it that they will be followed at no distant date by a full tide of Australian miners. It is said that already many subordinate Government officials, both in Burmah and at the Straits, have resigned their appointments in order to be early in the field. There seems little doubt that a discovery of valuable sapphire mines has been made in Siam, as not a few stones of value have found their way to Bangkok lately, where they met with ready sale.

HINTS TO REPAIRERS.

(Continued from page 61.)

IT frequently happens, in the more ordinary grades of English levers, that either the third or fourth wheels are rather large or small, or that the teeth are of a bad shape. In either case a new wheel must be substituted for the defective one. Whenever any doubt exists as to the depth being correct, set your depthing tool accurately by the holes in the plates, and then try in the doubtful pinion and wheel. If the depthing is correct, and the teeth the proper shape, the *entering* tooth will not come into action until it is near the line of centres, and produces a rolling action, not a *sliding* one. Try them carefully, both with a shallow and a deep depth, and carefully notice how they act in different positions; for, to determine whether the depth is correct or not requires some good common sense and experience. No one can learn how to do good work by books alone; it requires *experience* and *thought*; it takes time and patience to become at home in horological as well as in other matters. A watch will sometimes run and keep very good time when the third wheel is somewhat too large or too small, but the same error in the fourth wheel will cause the watch to stop occasioually; being so much farther from the motive power is the cause of this. In a case of this kind the "botcher" will put in a stronger mainspring instead of correcting the error. If new beginners, and, in fact, all those who have never had the benefit of proper instruction, would use the depthing tool more frequently, they would have better success. Some watchbreakers do not seem to care to have their bench cumbered with a depthing tool.

We will now take up the escapement. It is not our intention to go into a learned and scientific dissertation upon this subject, *à la Saunier*, but simply to give some practical information as to the proper plan to pursue in repairing the defective, broken, or worn parts of an already existing escapement. We wish to make these articles so plain and practical that the apprentice can easily understand and utilise them, which will stimulate him to study such scientific works in horological and kindred subjects as are now published, and tend generally to make him a good workman, if not a scientific horologist.

The escapement is recognised by all horologists as being the most important part of any time-keeping machine, and when a good workman has a watch placed in his hands for repairs, he gives particular attention to the escapement, well-knowing that a little defect or disarrangement of any of its parts would cause the watch to stop, or make it perform very irregularly; whereas the same amount of discrepancy located in any other part of the watch might not affect its time-keeping qualities at all. The escapement is, by the majority of workmen, but little understood. This seems a broad assertion, but how many are there who will read this article that can explain to an apprentice, for instance, the principles of a lever escapement; or, if a given escapement does not perform as it should, can point out the defect and administer the remedy, or who could by any possibility, make a correct drawing of a good working lever escapement?

We propose to point out some of the more common defects of the escapement met with in repairing the lever watch, and to give the remedy. One very frequent cause of a watch performing badly is to be found in the scape-wheel. The teeth become worn in the points (we are now speaking of a sharp-toothed wheel), which makes the wheel too small. The only remedy for this is a new wheel. Never try to hammer the teeth so as to make them longer; or, what is worse, never bend the teeth back.

Before taking the watch apart, and while there is power exerted on the escapement, remove the balance; then, with a piece of pegwood or other convenient article, try the escapement, by placing the point of peg-wood in the notch of the lever, and very slowly moving it until the tooth of scape-wheel passes from the *locking* face of the pallet arm to and over the *impulse* face, when the other arm of the pallets will lock the tooth of the wheel opposite to it, provided the escapement is correct. If the teeth of the wheel are worn much, or the corners of the pallet jewels are either worn or broken, instead of the wheel becoming locked, the tooth that ought to become locked will fall upon the impulse face of the pallet jewel and drive the lever back the other way. Sometimes this will be noticed in one arm of the pallet and then again in both. If the pivots of the scape-wheel or pallet staff are badly worn, or the holes too large for the pivots, either from wear or from having been made so by imcompetent or careless workmen, the same effect will be noticed sometimes. In examining the escapement try the side shakes, and carefully examine the pivots and holes to see if they are round and true. As before stated, if the fault is in the wheel, a new wheel must be put in.

Select a new wheel, a very little larger than the old one, exercising some judgment, so as not to get it too large; stone it down (using a sharp fine file first), if very thick, to about the right thickness; then, with a scratch-brush, clean off the burr formed by the stone, cement the wheel up in the lathe, true it up by the outside of the teeth, and bore out the holes in the centre to the proper size, take it down, boil out, and then polish it on a piece of touchstone or agate which has been ground with fine diamond powder, and another stone acting as a grinder. A stone prepared in this way will put a beautiful polish on a brass wheel in a few moments.

If a new collet is required for the scape-wheel, put a piece of brass wire in the lathe and drill a hole a little smaller than the staff of the scape-pinion, and turn it up to a proper shape on the end; cut off and broach out the hole to the right size, and then drive it on the scape-pinion. Cement the pinion up in the lathe, and proceed to fit in the scape-wheel and burnish it on tight. By fitting it on in this way it will be perfectly true. If the wheel is a little too large, again put it up in the lathe, and grind the points of the teeth down slightly with a piece of fine Arkansas stone, lubricated with oil; or grind it down by any of the processes recommended in former articles. If the pallet stones are either broken or badly worn, either put in new stones, or, if permissible, draw the old ones a little, and grind and polish them down to the proper shape and dimensions. In putting in a new stone, lap down a piece of garnet or chrysolite to the proper thickness, give it a rough shape, cement it into the slit in the end of the pallet arm, and grind it down almost to the steel, and then polish, using a brass or copper lap for all but the final polish, which is given with boxwood and diamond powder. The copper laps or mills can be made out of old half-pence, and faced up, and charged with diamond powder. One carat of diamond powder will last a watchmaker from five to ten years, and no one who has once used it, will ever consent to do without it. In polishing a stone with diamond powder, it will be necessary to examine it with a double eye-glass, to see if it is perfectly smooth and polished; if it is not, the ends of the teeth of the scape-wheel will be ground off in a short time after the watch has been in use.

(To be continued.)

ENGLISH WATCH COMPANY.

FOR the convenience of their large and continually increasing metropolitan connection, the above company have established a branch office at Waltham Buildings, Holborn Circus, E.C.

ON THE DEMAGNETISATION OF WATCHES.

MR. ALFRED M. MAYER, of the Stevens Institute of Technology, New York, has contributed a series of very elaborate and instructive articles to our able American contemporary the *Scientific American* on the subject of magnetism, with special reference to the demagnetisation of watches. Mr. Mayer enters very minutely into the laws regulating the various actions of magnetism; but supposing our readers to have at least an elementary knowledge of the subject, we give only the descriptions of a few practical experiments, which will certainly prove useful.

"A watch," says Mr. Mayer, "is formed of a case of gold or silver, and glass, inclosing brass or nickel plates, between which are a number of steel arbors, forming the axles and pinions of the brass wheels. There is also the spring of steel which uncoils itself in the plane of the watch. The older watches have in addition a steel chain which uncoils from the fuzee on to a brass barrel inclosing the mainspring. The hairspring, parts of the balance wheel escapement, stem winding apparatus, etc., are also of steel. So we see that there is abundance of material for magnetisation in a watch. Fortunately these parts are formed of steel, which is only moderately hard, and therefore easy to demagnetise.

Of these various parts some have their lengths at right angles to the plane of the watch, like the arbors; others, like the main and balance wheel springs and the nickel (nickel takes a magnetic charge like steel or iron, only feebler) plates inclosing the movements, have their greatest dimension in the plane of the watch. The position of these bodies determines to a great extent the directions of their magnetic axes. By magnetic axis we mean an imaginary line joining the two poles of a magnet. The arbors will have their magnetic axis in the direction of the lengths, whereas plates are most likely to have theirs in the direction of one of their diameters. But no matter in what direction their magnetic axes are in the watch, all of these bodies may be demagnetised *by properly oscillating the watch before the pole of a magnet.* How this is to be done I will now show, and in order to shorten what might otherwise be a long story, I will give an account of the process by describing the experiments actually made in the course of demagnetising an old Tobias fuzee watch, which I saturated with magnetism by deliberately placing it on one of the poles of the large magnet of my laboratory in the Stevens Institute of Technology, and thus purposely obtained a very badly magnetised watch to practise a cure on.

The watch is placed quite close to the magnetometer, and with the centre of the thickness of the watch about on a level with the centre of the needle of the magnetometer, and with the line connecting the centre of the watch and the centre of needle, at right angles to the magnetic meridian; in other words, at right angles to the direction which the needle has when no magnetic body is near it. The watch is then turned slowly round on its centre as on an axis, and each hour on its dial is in succession brought opposite to the centre of the magnetic needle of the magnetometer.

The following were the results of such experiments on our magnetised watch. We give them in the form of a table: N and S indicate the kind of magnetic polarity at each hour, and the angles show the effect in angular deflection on bringing that hour of the dial opposite the centre of the magnetometer needle :—

TABLE I.

Hour.	Angle of Deflection of Magnetometer.	Kind of Magnetism.
XII.	20°	N.
I.	5°	N.
II.	18°	S.
III.	72°	S.
IV.	56°	S.
V.	22°	S.
VI.	5°	N.
VII.	17°	N.
VIII.	16°	N.
IX.	16°	N.
X.	20°	N.
XI.	24°	N.

When the hour III. was brought opposite the magnetometer needle, the fuzee axle and the centre of the semicircular steel catch of the inner cover of the works were presented to the magnetometer. The strong south magnetism of hour III. was due to the magnetisation of these bodies, which deflected the needle of the magnetometer 72°. The strong north magnetic action of hour XI. was due to the magnetised mainspring.

We may now regard this watch as a magnet, having the form of a disk, and with its north magnetic pole at the hour XI., and with its south pole at III. o'clock. This being the information given by our magnetometer, we are in possession of facts which enable us to take the north magnetism out of eleven o'clock and the south magnetism out of three o'clock. When the north pole of one magnet is brought near the north pole of a more powerful magnet, the powerful magnet will take the magnetism out of the weaker one, because it tends to make the north pole of the latter a south pole. Similarly the south pole of a powerful magnet will demagnetise the weaker magnet when the south pole of the latter is brought near the south pole of the former.

Another fact is that when a small magnet made of steel, not too hard, is vibrated about its centre in front of the pole of a powerful magnet the small magnet is demagnetised. These facts show how we must proceed in the demagnetisation of the watch.

The hour XI. is of the strongest north magnetism of any on the dial; therefore we place this hour opposite the north pole of our rat-tail file magnet. The centre of the watch is placed so that the prolongation of the axis of the magnet passes through it. The watch is now vibrated around an axis passing through the centre of the watch and at right angles to the prolongation of the axes of the magnet. After several vibrations of the watch before the north pole of the magnet, I turned the hour III., of strong south polarity, opposite the south pole of the magnet, and vibrated the watch again as previously. By these vibrations the watch cuts across the lines of magnetic force, and, as we have seen, any magnetism in it is thus taken out. After these operations performed on the hours XI. and III., the watch was again examined before the magnetometer, and the following table shows the effect of the vibrations before the magnet.

TABLE II.

Hour.	Angle of Deflection of Magnetometer.	Kind of Magnetism.
XII.	2°	N.
I.	5°	N.
II.	4°	N.
III.	0°	
IV.	5°	S.
V.	8°	S.
VI.	2°	S.
VII.	4°	N.
VIII.	4°	N.
IX.	2°	N.
X.	1°	N.
XI.	0°	

There is certainly a great difference between the magnetometer deflections of Table I. and those of Table II. It is observed at once that the hours III. and XI., which were respectively of strong south and north magnetism in Table I. are in Table II. marked 0°. This result was not attained, however, at one trial, as might be inferred from our description of the experiments, but after each series of vibrations before the pole of the demagnetising magnet the magnetic condition of hours III. and XI. was tested. Sometimes their magnetism almost disappeared. Then we found it had changed, or rather inverted, so that hour III. had north instead of south polarity, and XI. had south instead of north magnetism. When this happened we had to present hour III. before the north pole of the magnet, the hour XI. before the south pole. After repeated trials I succeeded in demagnetising hours III. and XI., so that they produced no action whatever, or 0°, on the needle of the magnetometer.

I now again brought the watch before the magnet and vibrated its V. o'clock before the south pole till this south magnetism had disappeared; in other words, produced no deflection whatever in the needle of the magnetometer. I then made an examination of the magnetism of the watch before the magnetometer, with the following results:—

Table III.

Hour.	Angle of Deflection of Magnetometer.	Kind of Magnetism.
XII.	1°	
I.	0°	
II.	0°	
III.	0°	
IV.	2½°	S.
V.	2°	S.
VI.	2°	N.
VII.	6°	N.
VIII.	5°	N.
IX.	2°	N.
X.	1°	S.
XI.	2½°	S.

I now demagnetised hour VII. of its 6° of north magnetism by vibrating this hour opposite the north pole of the demagnetising magnet, and after I had succeeded in this I found that no hour on the dial of the watch when presented to the magnetometer caused a deflection of even one degree, so I considered the watch demagnetised, in which conclusion I was justified, for the watch has kept good time, and with about the same rate as it did before it was magnetised. I also demagnetised a valuable carefully made watch by Lange, of Dresden, which had accidentally become magnetised. It was so strongly magnetised that IV. o'clock on its dial produced a deflection of 83° south magnetism on the needle of the magnetometer, and VII. o'clock a deflection of 40° north magnetism. This watch I demagnetised exactly as has been described, and after its demagnetisation, though it has lost a half hour in three hours when magnetised, it kept a rate even more uniform than before its magnetisation. Before its magnetisation it lost about one second per day; after its demagnetisation it has gained from ¼ to ½ second per day, and has a very uniform rate, indeed, as uniform as one could wish for in a pocket watch subjected to daily vibrations on the railway.

HANDSOME PIECE OF GOLDSMITHS' WORK.

BADGES and jewels of a splendid character are by no means confined to the civic dignitaries of London. A magnificent jewel badge has just been supplied to the Merchant Venturers' Company of Bristol by Messrs. Taylor & Co., Jewellers, of College Green, in that city. The company dates back to 1459. The very handsome coat of arms which appears on the badge has recently been revised at Heralds' College, and gives scope for the display of fine art goldsmiths' work in the form of figure modelling and enamel painting. The border is formed of elegantly-designed gold scroll work, pierced and carved out of the solid metal; above and below the arms is a large cluster of brilliants of the choicest quality. This ornament was manufactured by Messrs. J. R. Williams and Son, 108, Hatton Garden, and is altogether a beautiful work of art. It has been submitted to the Princess of Wales, at Marlborough House, and her Royal Highness expressed her admiration of the design and workmanship.

Singular Discovery during a Sale by Auction.—Mr. John Bernal, auctioneer, was conducting a sale of household furniture, and a collection of antiques and old paintings the other day in the residence of an old gentleman, Mallow Street, Limerick, who took a delight in the possession of such articles. Mr. Bernal was about to offer three worthless-looking boxes and whatever they contained "on chances," when an intending bidder kicked one of his boxes with his foot, and finding it heavy he made further examination, when the box yielded up the sum of £40 in silver. This led to a search of the second box, in which £20 in silver was found. The third was tried, and in it were found three gold watches, jewellery, and diamonds in antique settings, and other valuables. The accidental discovery of the intending bidder will put a considerable sum into the pocket of the owner, an eccentric old gentleman, who might otherwise have let the treasury of money and jewels go for almost nothing.—*Northern Whig.*

A rather ingenious diamond robbery is said to have taken place at Antwerp last week. In France and Belgium, as most people know, it is more usual for shops, even of the better class, to be wholly attended to by the family of the tradesman than by hired assistants. The jeweller in question, M. Nys, appears to have had a staff consisting of himself, his wife, his son and his daughter. The plan of the robbers was to eliminate one by one the members of his staff. They watched until the jeweller and his daughter went out for a walk, then one of the confederacy went in and asked to see the master. Finding that he was out, he pressed that a deputy should be sent with him to value some jewellery. The son was despatched on this errand, and thus the wife was left with the shop on her hands. Then another person, well dressed and imposing in appearance, entered the shop, and asked to look at some trinkets. He was very difficult to please, and Madame Nys became engrossed in the task of endeavouring to suit him. Meanwhile a third person managed to slip unnoticed through the passage which led to the dwelling-house behind the shop, and to go out again, equally without attracting attention. At last the fastidious gentleman chose a pin of small value and departed. When the jeweller came home it was discovered that a box which was on the table in the back shop had been carried off, and this box contained diamonds to the value of nearly a thousand pounds. Of course, it may be said that only great carelessness would have left such valuable property lying about, and that only the same carelessness would leave a shop such as a jeweller's, where a sudden dash might always reward the plunderer, under the care of a single person. But the fact that the raid was made not on the shop itself but on the compartments behind looks very much as if the robbers knew what they had to expect there—that is to say, as if there were traitors in the camp, Antwerp is not far from England, and London jewellers might perhaps advantageously be on their guard against this gang.—*Daily News.*

DIAMONDS.

DIAMONDS, so the trade reports tell us, are once more coming into brisker demand, and, in spite of new sources for the gem, the supply does not seem to suffice. One secret that Nature still jealously guards from man is the composition of those exquisite crystals which we call "precious stones." Fairy stories and Eastern legends therefore diligently concern themselves with the diamond and emerald, sapphire, opal, ruby, and amethyst. For these, at any rate, there is still a fragment of beautiful wild Nature not yet enclosed by science, a common whereon the children of fancy can still disport themselves as they please without any aggravating intrusion of superior authority. Wise men may elaborate a prosaic chemistry, producing crystals which they declare to be the fac-similes of Nature's delightful gems; but the world will not accept the ruddy residue of a crucible full of oxides as rubies, or the shining fragments of calcined bisulphides as emeralds. No crucible yet constructed can hold a native sapphire, and all the alchemy of man directed to this point has failed to extort from carbon the secret of its diamond—the little twelve-sided crystal that earth with all her chemistry has made so few of since first heat and water, Nature's gem-smiths, joined their forces to produce the glittering stones. They placed under requisition every kingdom of created things, and in a laboratory in mid-earth set in joint motion all the powers that move the volcano and the earthquake, that re-fashion the world's form and substance, that govern all the stately procession of natural phenomena. Yet with all this Titanic labour, this monstrous co-operation of forces, Nature formed only here and there a diamond and here and there a ruby. Masses of quartz, crystals of every exquisite tint, amethystine and blue, more beautiful, perhaps, in delicacy of hue than the gems themselves, were sown among the rocks and scattered along the sands, but only to tell us how near Nature came to making her jewels common, and how, just when the one last touch was needed, she withheld her hand, that man should confess the triumphs of her art were indeed "precious."

Ages ago, when the list of minerals was much less complete than at present, men were admitted merely to the knowledge of the imperfect gems, and treasured, therefore, stones which, though very beautiful, are no longer among the highest prized. For emeralds they had only malachite, for sapphires lapis-lazuli, and jaspers, agates, carnelians, alabaster, onyx, and beryl, all ranked as precious stones. Knowledge, however, advanced with science, and men found that the minerals they had thought so rare abounded in the secret treasures of the rocks. From the crowns of Princes, the painted stones came to pave the palace floors, and instead of being mysterious substances armed with strange powers, were enlisted for the adornment of household furniture. Arabesques of dainty minerals appeared on the temple walls of the East, and in the architectural fanes of every nation the quasi-precious stones of former days lent their colours to give relief and grace to the severer beauties of the building. A new treasure trove had then been sprung. Nature, it was found, had carried her chemistry further towards the perfection of hue and brilliancy than in her rock masses and pebbles, and so the supreme representatives of wealth came to be the stones which to this day constitute the ideal standards of worth and beauty. But there are surprises yet in store for humanity, and one by one, it may be, the ruby, the emerald, and the rest will decline to the second rank, as the onyx and the turquoise have already done, in the presence of further revelations of the earth's crystals. Again and again, even within the present century, the gem markets have borne witness to sudden revolutions in fashion, and unexpected changes of taste; but a modern writer traces these to the fact of allied crystals depreciating, by their abundant appearance, the worth of their nobler relatives. Diamonds are not now all of one kind—a genus without species, a species without varieties—for there are a dozen sorts, each differing from the other in beauty and in value; but the original "diamond"—of the pure water of the Brazilian or Eastern stone—still commands a universal homage. If however, the other varieties, which differ from their splendid prototype only microscopically, were any day to be made worthless by their profusion, the king of the gems itself would seem to dim in lustre. If Nature, exasperated by the persistent efforts of men, were in revenge to disclose to the prying pick-axe a solid crag of "Cape Diamond," or a lode of beryl-emerald, the markets for the true gems would be glutted with a jewel so near the truth, that the truth itself, multiplied in exquisite replicas, would come to be held less precious. Already the fanciful beauties and powers which our forefathers imputed to gems are obscured and discredited. What husband, suspecting an unfaithful wife, would nowadays smuggle emeralds into her food, or what wife, seeking to redeem a drunken husband, would secrete amethysts in his liquor? The onyx has lost the latch-keys of the dream gates, and no oracle now speaks from the opal. We shall have to look very long, indeed, into the aqua-marina before we read another's thoughts in it, and the diamond sparkles as brightly for the knave as for the honest man. Eastern peoples still venerate, while they delight in, the quaint phantasies of the mineral world—the hieroglyphic agate, and luck-assuring "cats eye," the ominous moonstone, the unlucky tourmaline, and the carbuncle all aglow with malignant fire. The jewelled rocks of Ceylon contain within them a mythology of vast extent and wildest exuberance; and the streams of Burmah are strewn with sapphires—white, blue, and black—and bastard rubies and mimic amethysts, to all of which attach the same superstitions and traditions that are claimed by the more splendid treasures of the Indian mountains and rivers. All the human affections and passions are under the influence of gems, and each gem again has its tutelary sprites, who direct its powers for good or evil. From the cradle to the grave, in sickness or in health, in prosperity or adversity, the Oriental may take counsel of a jewel or seek its help, and no circumstance of his life is without its precedent of subjection to the potent agencies of "the precious stones."

In the West, these supernatural potencies of the rarer minerals have been dispersed by ruthless chemistry. Newton spoke profanely of the diamond as "an unctuous substance coagulated," and popularised science nowadays pretends to sneer at the glory of diadems as "only charcoal, after all." Chemists set down on paper exactly how many acids and vapours, acting upon how many salts and alkalis, would produce, if the elements would all lend their aid in a supreme effort of creative force, a "precious stone," and by their laboured explanations bear witness to the dignity of the gems they long to imitate. New influences, moreover, have gathered round the Royal crystals. While the emerald has disclosed to the inquirer after its composition a valuable fact of the action of gases, the diamond has lent itself to boring rocks. A hollow cylinder, edged with diamonds and revolving rapidly, ate its way in a single hour, through a rock which by any other known means it would have taken two days to pierce, and the diamonds that had done it were found to be absolutely unaltered by the tremendous friction—too proud to confess even to the blunting of a single edge on its surface. But it is not for the chemical properties, or their existence in human industries, that precious stones will maintain their hold upon the imaginations of men. In the weakness of our nature, we must have an ideal of beauty from which to deduce our standards of worth, and as yet we have found nothing to excel the twelve-sided crystal we call a diamond. Ever since it was known to man it has reigned supreme over the fancy, and whatever the race, whether in the East or the West the diamond has never been supplanted as the most beautiful thing vouchsafed to humanity. The historical gems—"the Royal stones," as they are called—of exceptional size and fabulous value do not alone claim this pre-eminence, for the smallest fragment that suffices to give a glimpse of the prismatic glories of the larger stones is treasured. With other gems size often—in emeralds, in the East, notably—establishes a claim to value, but the diamond disdains honour for the mere material virtue of bulk. The boasted gem of the Borneo chief, three times the dimensions of the Koh-i-noor, collapsed on inspection to a third-rate stone. It had size and weight, and was a diamond, but the stone had no soul. It was a dead diamond. If all crystals had been in the same way judged, merely by colour and magnitude, we should have had no lack of gems, but then neither beautiful legends nor the homage of men would have gathered round the exquisite things, and the mysterious depths of translucency, tones of pure colour, and wondrous lustre would never have been known to us in the supreme combination of the perfect gem of modern days.—*Daily Telegraph.*

Mr. Bryce-Wright, a well-known authority on gems, in a letter to the same paper in reference to the above, states:

"Your excellent article upon diamonds will have been read, I am sure, by many with the greatest interest. Speaking, however, of the form of this gem, in two places, you allude to 'the little twelve-sided crystal,' leading the generality of readers to suppose, perhaps, that this, the rhombic dodecahedron, is the common form. Belonging to the cubic or isometric system, diamonds certainly occur at times as twelve-sided crystals; but the prevailing form is the octahedron, the planes of which have frequently the peculiarity of being convex. Nearly the whole of the large stones discovered at the Cape have been flattened, modified, or regular octahedrons."

JEWELLERY IN RELATION TO ART.*

It is an admitted fact that the principles of true art are not much understood in relation to dress and ornament, and that they are still less frequently exemplified in modern practice. Fashion is the one controlling law, and it is obeyed, no matter what the result. Mr. E. J. Watherston has therefore deserved well of the world for calling attention to the subject of the place of jewellery in art. He thinks this topic is almost entirely overlooked, and perhaps it is in this country. Hence he asks, "Whenever was a lady heard to consult a jeweller as regards her earrings, bracelet, or necklet?" The consequence is seen in the most unsuitable arrangements: "a lady to whom rubies are most becoming will wear emerald or turquoise ornaments, regardless of the colour of her dress; another will insist on decorating herself with gold, while silver would be the most befitting." What is true of the colour is equally true of the form, and we have tight bracelets on stout wrists, and loose ones on slender wrists, and so forth. Mr. Watherston thinks the ancient Greeks and Romans were wiser. They did not wear hats and bonnets, and they paid particular attention to their earrings, the models for which are far better than many now in fashion. In like manner he maintains that modern necklaces are inferior in design to the ancient. He is, of course, aware that the Greek and Roman ladies not only dressed their hair often in a most elaborate style, but that caps and other coverings are represented in ancient art work. The head was adorned, or, if not the head the headdress was adorned, with costly ornaments of every kind; but in general the coiffure seems to have been so arranged that the ears were visible, and of course the ear pendants. And so with regard to the neck, the apparel being so ordered that the necklaces would be quite conspicuous. It is very clear that under these circumstances we should labour under a disadvantage even if we copied with exactness the ancient patterns. The ornament should harmonise with the dress—should, in fact, be a continuation of it, and a set-off to it. All that can be done in this case is, perhaps, to devise some style of jewellery which shall accord with modern fashion in dress. This is not a very great difficulty we fancy, and we shall be obliged to jewellers who will endeavour to accomplish what we hint at. It is evident that they can indicate what colours and forms are most suitable in special cases, and can tell us what is most proper to wear by natural or by artificial light. Some of them are men of refined artistic tastes, have great skill in design and execution, and are zealous for the honour of their profession. Let them go resolutely into the matter, and give us the knowledge which results from their observations. They may exercise a wholesome influence upon taste, and if they do that they will have a voice in determining the fashion. To some extent they do this now, but not to the extent demanded, and there is little or no co-operation between them and the milliner. The last-named must have an ear as well as a voice, and they must be ready to listen to the jeweller, and to take counsel with him. We all know how carefully the modistes study the complexion and general physique of those whom they undertake to dress, in the highest style and the most effective manner. But they are not on intimate terms with the jeweller; and even if they dictate the kind of ornament which shall be added to their proper work, they often fail from an artistic point of view. The reason of their failure is evident: jewellery is not their speciality, and they have not studied it. We have no doubt that if form and colour in the matter of jewellery, and even the amount to be worn, were more carefully attended to, there would be a great improvement. The mere blaze of diamonds, the glitter of rubies, the sheen of pearls, and the varied sparkling tints of emeralds, sapphires, &c., would become greatly more effective than they too generally are. Mere money value, massiveness, and quality would not be the chief considerations. Other and higher aims would be sought, and ladies would endeavour to set off the graces of their person or the splendid beauty of their dress in accordance with the true principles of decorative art. A proper selection and arrangement of gold and gems might readily be made to harmonise with features and complexion as well as with the colour, materials, and style of the attire. The arts of the jeweller and goldsmith are confessedly not what they ought to be, because not what they have been and might be. But they labour under restraints, and artists work for the market rather than for art. The popular taste is practically fatal to them; and, however costly or striking the works they execute, they fail to satisfy the demands of refined criticism. If the purest principles were adopted we should soon see the last of many of the absurd devices and patterns which are now so common. The imitations of animals, leaves, birds, &c., which are often shown in gold and gems, would, for example, disappear. They are incongruities and barbarisms, and as such they would yield to arrangements more worthy of the value, beauty, and dignity of precious stones, and more exquisitely lovely. We should probably have patterns of a more severely classic style, more chaste and graceful; but surely these would be far more elegant and effective than the complicated groupings with which we are familiar. The question of expense need not be raised; but we are sure that a higher style, better workmanship, and genuine materials would command admiration, and therefore their price. Other points must be dealt with, but for the present let these suffice. We conclude now, therefore, by expressing our obligations to Mr. Watherston for bringing this subject forward, and our hope that it will not be lost sight of.—*Queen.*

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* See *Watchmaker, Jeweller, and Silversmith*, of December, 1878, January, February, and March, 1879.

THE

Watchmaker, Jeweller, & Silversmith,

A MONTHLY TRADE JOURNAL,

Devoted to the interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades; published at Milner's Buildings, Moorgate Street (Opposite Moorgate Street Station), London, E.C. Booksellers and Newsagents supplied by Messrs. Catty & Co., 12, Ave Maria Lane, Paternoster Row, E.C.

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Mr. J. H. Johns is the only authorised traveller for this Journal.

Receipts for subscriptions will only be sent when asked for, and on receipt of postage stamp for such purpose.

PATENTS.

Applications for Letters Patent.

4451. William Robert Lake, of the firm of Haseltine, Lake, and Co., Patent Agents, Southampton Buildings, London, for an invention of "Improvements in and relating to clocks and other time-keepers."—A communication to him from abroad by Arthur Ethelbert Hotchkiss, of Cheshire, Connecticut, United States of America, Mechanic.—(Complete specification.)—Dated 31st October, 1879.

4460. Frederick James Barnes and Edward Kirby, both of Birmingham, in the county of Warwick, for an invention of "Certain improvements in the construction and fastenings of buttons, solitaires, studs, brooches, and other articles of jewellery and dress."—Dated 1st November, 1879.

4682. Edward John Payne, of Birmingham, in the county of Warwick, Patent Agent, for an invention of "Improvements in bracelets, cuffs, and necklets."—Dated 18th November, 1879.

Grants of Provisional Protection for Six Months.

4208. To Louis Frederic Portebois, of 10, Rue de la Fidélité, Paris, in the republic of France, clockmaker, for the invention of "An improved calendar."

4218. To Juan Francisco Nepomuceno Macay, of Charapotó, in the republic of Ecuador, South America, and at present of York Place, Baker Street, in the county of Middlesex, for the invention of "Improvements in the production of colcothar or jewellers' rouge (ferric oxide), and cupric chloride."

4493. To William Robert Lake, of the firm of Haseltine, Lake & Co., Patent Agents, Southampton Buildings, London, for the invention of "A bracelet with an improved fastening."—A communication to him from abroad by the Company Veuve Aug Barbier et fils and Fernand Maloubier, of Paris, France.

Patents Granted in Foreign States.

France.

125,590. Baron, for "A click and spring work for clocks."—Dated 19th April, 1879.—Class 12.

130,172. Levasseur, for "Obtaining cameo imitations on precious stones." Dated 15th April, 1879.—Class 17.

130,191. Casse, for "Minion clocks and barometers with independent ornamental panels."—Dated 17th April, 1879.—Class 12.

130,240. Kierdorff and Co., for "An unoxidizable alloy with a base of silver, applicable for jewellery, &c."—Dated 21st April, 1879.—Class 17.

130,241. Kierdorff and Co., for "Mounting fine pearls for jewellery."—Dated 21st April, 1879.—Class 17.

130,246. Texier De La Pommeraye, for "Manufacturing and regulating compensation clocks."—Dated 22nd April, 1879.—Class 12.

130,257. Fénon, for "Timing public and other clocks."—Dated 22nd April, 1879.—Class 12.

130,265. Berthoud, for "A mechanism for remontoir watches."—Dated 22nd April, 1879.—Class 12.

130,267. Personne, of Dijon, for "A meridian with an automatic striking-work."—Dated 8th February, 1879.—Class 12.

130,281. Wehrlin, for "Hinges for medallions, lockets, &c."—Dated 23rd April, 1879.—Class 17.

130,331. Ham, junr., and Pierce, junr., for "Maritime clocks."—Dated 25th April, 1879.—Class 12.

121,835. Orry, for "A chain for jewellery."—Dated 21st April, 1879.—Class 17.

125,578. Lion, for "Jewellery articles and their manufacture."—Dated 25th April, 1879.—Class 17.

130,434. Schwehr, of Paris, for "Applying shanked jet to jewellery."—Dated 2nd May, 1879.—Class 17.

United States of America.

220,227. Henry P. Fiske, of Waterville, Conn., assignor of one-half of his right to Allen Fisk, of Portland, Me., for "Striking-movements for clocks."—Application filed 21st January, 1879.

220,233. Pauline H. Gontard, of Cortébert, Switzerland, for "Stem-winding watches."—Application filed 17th June, 1879.

220,401. Etienne M. L. Maxant, of Paris, France, for "Invisible clock-winding mechanisms."—Application filed 1st April, 1879.—Patented in France, 5th March, 1879.

220,462. James Arkell, of Canajohari, N.Y., for "Time-globes."—Application filed 6th March, 1879.

220,480. Louis P. Juvet, of Glens Falls, N.Y., for "Time-globes."—Application filed 7th February, 1879.

220,724. John A. Miller, of Paducah, Ky., for "Clocks and watches."—Application filed 26th June, 1879.

220,763. John Jay Johnston, of Pittsfield, Ill., for "Escapements for time-keepers."—Application filed 24th April, 1879.

220,815. Frank A. Earl, of Ypsilanti, Mich., for "Removable potances for watches."—Application filed 24th May, 1879.

220,916, Ezra C. Fitch, of New York, N.Y., for "Stem-winding watch-keys."—Application filed 16th August, 1879.

Notices to Proceed.

3017. Alexander Melville Clark, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, has given notice in respect of the invention of "Improvements in keyless watches."—A communication to him from abroad by Pauline Gontard, of Cortébert, Switzerland.

2717. Francis Hope, of Birmingham, in the county of Warwick, Manufacturer, has given notice in respect of the invention of "Improvements in shirt and other studs, solitaires, and other dress fastenings and ornaments."

3019. Thomas Southgate, of Burtou Crescent, in the county of Middlesex, Gun Maker, has given notice in respect of the invention of "Improvements in the construction of wrist and other studs or solitaires."

4451. William Robert Lake, of the firm of Haseltine, Lake, & Co., Patent Agents, Southampton Buildings, London, has given notice in respect of the invention of "Improvements in and relating to clocks and other timekeepers."—A communication to him from abroad by Arthur Ethelbert Hotchkiss, of Cheshire, Connecticut, United States of America, Mechanic.

Patents Sealed.

2989. John Price Hunt, of Birmingham, in the county of Warwick, Jeweller, for an invention of "Improvements in or relating to earrings, ear-studs, necklets, chains, and bracelets, applicable to other ornamental and useful articles or appendages."—Dated 23rd July, 1879.

1955. Henri Robert, of 34, Clerkenwell Road, in the county of Middlesex, Watchmaker, for an invention of "Improvements in watches."—Dated 15th May, 1879.

Inventions protected for Six Months on the Deposit of Complete Specifications.

4451. William Robert Lake, of the firm of Haseltine, Lake, and Co., Patent Agents, Southampton Buildings, London, praying for Letters Patent for the invention of "Improvements in and relating to clocks and other time-keepers,"—a communication to him from abroad by Arthur Ethelbert Hotchkiss, of Cheshire, Connecticut, United States of America, Mechanic, was deposited and recorded in the Office of the Commissioners on the 31st day of October, 1879, and a Complete Specification accompanying such petition was at the same time filed in the said office.

MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Worrall, Charles, Caroline Street, Birmingham, electro-plate manufacturers. Oct. 31. Buller & Bickley, sols., Bennett's Hill, Birmingham.

Toleman, John, High Street, Pwllheli, watchmaker. Nov. 4. C. Owen, sol., Pwllheli.

Westley, Frederick, Old Bond Street, Piccadilly, and Cathcart Road, West Brompton, optician. Nov. 3. Letts Brothers, sols., 8, Bartlett's Buildings.

Smith, Alfred, Kirkgate, Huddersfield, silversmith. Nov. 12. Learoyd & Co., sols., Huddersfield.

Squires, Thos. Henry, Lower Rushall Street, Walsall, electro-plater. Nov. 11. F. Bill, sol., Walsall.

Wolf, Herbert, Boar Lane, Leeds, jeweller. Nov. 15. B. C. Pullan, sol., Leeds.

Harris, Frederick, Berry Street, Liverpool, jeweller. Nov. 22. Spinks & Gawith, sols., Thomas Street, Liverpool.

Hermann, Joseph, Dartford, Kent, watchmaker. Nov. 19. Haywards & Co., sols., 5, Frederick's Place, Old Jewry.

Rowley, Alfred, trading as A. & S. Rowley, 34, Clerkenwell Road, and 6, Kirby Street, Hatton Garden, diamond merchant and jeweller. Nov. 8. Kidder & Sons, sols., 19, John Street, Bedford Row.

Royle, Samuel, & Peter Fray Rawson, Wigan, Lancashire, watchmakers and jewellers. Nov. 19. Scott & Ellis, sols., Wigan.

Whiting, George, South Street, Sheffield, watchmaker. Nov. 22. O. H. Porrett, sol., Sheffield.

Dissolutions of Partnerships.

Hughes & Clark, Everton Road, Liverpool, jewellers. Oct. 8.

Laval & Wright, Thavies' Inn, Holborn, watch manufacturers. Oct. 29.

Last Day for Lodging Claims.

Orams, Jeremiah K. (Liq.), Chelmsford, jeweller. Claims by Dec. 10, to F. B. Leeming, 10, Coleman Street.

Dividends.

Tritschler, Ferdinand H. (Liq.), Carlisle, jeweller. 1st div., 10s. M. A. Fitter, sol., Bennett's Hill, Birmingham.

Bryan, Edward (Liq.), Cross Street, Manchester, optician. 1st and final div., ½d. S. Murray, accountant, 25, Brazennose Street, Manchester.

Burrow, Robert, trading as R. Burrow & Co. (Liq.), Hatton Garden and Arlington Square, Islington, watch importer. 1st div., 4s. G. Holloway, 123, Minories.

Trustees Appointed.

Hearn, William (Bkt.), Stroud Green Road, jeweller. Tr., E. C. Moore, accountant, 3, Crosby Square.

Lumley, John (Liq.), St. Martin's Road, Stockwell, jeweller. Tr., J. M. Banks, jeweller, Northampton Street, Birmingham.

Adjudications of Bankruptcy.

Dold, Anton, Victoria Street North, Great Grimsby, jeweller. Nov. 3. Daubney, Reg.

Finding, Samuel, Well Street, Bedford, watchmaker, &c. Nov. 5. Pearse, Reg.

Prices Current for Gold and Silver.—Value given for Old Gold and Silver by Assay.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

Prices Charged for Gold and Silver.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver, 4s. 6½d. to 4s. 9d. (variable according to quantity).

Messrs. Tillotson & Son, of Bolton, have just published, through Messrs. Maxwell, of Shoe Lane, Fleet Street, a manual of the decimal system, for the use of jewellers, silversmiths, etc. The work will be found of considerable value to the trade, and contains a variety of useful and valuable information.

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ANTIQUE COIN JEWELLERY.

THE present reigning fashion of setting antique coins of gold and silver as jewels, is by no means a modern invention. Jewellery among the Ancients as soon as civilisation had made some slight advance, ceased to be purely ornamental, and became symbolical—that is to say, conveyed some meaning either for the person who wore it, or the person who had given it.

In many of the tombs of Greece we find coins set as jewels, often with very elaborate settings, though in general the only pieces found are what were termed "funeral jewels," and made in the least expensive way possible to produce the necessary show; for the Ancients were too practical to bury with their dead things of great value. Thus the jewels in the Castellani and di Cesnola collections are of very light material, and decorated in a manner which can give but a faint idea of the talent of the goldsmiths of Athens or Rome. The funeral jewels consisted of rings, ear-rings, sometimes a clasp, and often a diadem wider in front than at the ends; the extremities and front are pierced with three holes, through which passed the strings which attached the jewel to the head, but no vestiges of their cords have ever been found.

This jewellery has reached us in a good state of preservation, for it was not always easy to find; and also because of certain superstitious reasons which prevented the barbarians, when they swept down and to a great extent destroyed the civilisation of Rome, from removing them; but they melted or broke up everything valuable they could lay their hands on, and by the few specimens which accidentally escaped destruction, we can surmise what a wealth of beautiful things were annihilated by these barbarian invaders.

In the Celtic and Frank tombs, jewellery of quite a different character is found; it is heavier though not so well wrought, but it contains precious stones, and even diamonds, though uncut or only rudely shaped into "cabochons."

The first jewel was the ring, which we find in all historical documents from the earliest time. For many centuries rings were a current coin, and were used as such by the Egyptians until after the dynasty of the Ptolemies, that is, until Greek princes reigned over Egypt, and introduced the Grecian coinage. Rings were also used as signets, and served to attest public documents and private contracts. The Egyptian Scarabee had a name or inscription cut into the lower surface, which made it available to make an imprint in wax or any other plastic substance. Soon the art of cutting intaglios made great advance, and reached its highest degree of perfection about two hundred and fifty years before Christ.

The New York Museum of Art is likely soon to possess an important collection of antique intaglio rings, which was made by the Rev. C. W. King, of Cambridge, in England, who is one of the most learned writers on the Egyptic art. Mr. J. T. Johnston, to secure it for the Museum, purchased it for himself—holding it for six months at the disposal of the Museum, thereby allowing the trustees ample time to raise the necessary funds.

The principal feature of antique stone cutting, and that to which a great deal of its merit is no doubt due, is the fact that the cutter and the designer were generally the same man. The amount of action and life thrown into the figures is wonderful, and no mechanic could have cut a stone so artistically, had he not himself conceived the subject. Subdivision of labour is the great cause of the artistic inferiority of modern productions compared with those of the Ancient and even the Renaissance periods.

The inscriptions on antique jewels are in most cases the name of the possessors. On intaglios the name of the owner cut on the stone has often been taken for the signature of the artist. On Roman rings mottoes are often seen. For instance, the following, "*Accipe multis annis dulcis,*" has been found in open work. In the middle ages the implanted superstitions led people to seek means of protection of an equally mysterious character. Thus precious stones were set as rings or amulets, and endowed with some mystic virtue. The Beryl, for instance, was a charm against enemies; moon stones made the bearer proof against steel; others warn the wearer against danger or poison.

Pre-historic bangles and bracelets have been found in the lake dwellings of Switzerland, and some of them show an advanced stage of workmanship. They are in bronze, cast in moulds and ornamented with chasing.

In modern times, imitation of the jewellery of the Ancients has been much in vogue at different times. The Empress Eugenie, once appeared at one of the balls at the Tuileries wearing an exquisite Egyptian necklace of antique make. A well informed archæologist, in passing, complimented her on wearing that magnificent gem, which for centuries had rested on the breast of a Royal Mummy. Her majesty, disgusted at the thought, at once tore the jewel from her neck, and sent it back to the dealers who had sold it to her. It is now in the collection at the British Museum.

The Duchess of St. Albans has a necklace very elaborately set in gold, the twelve medallions of which are each a gold coin (aurei) of each one of the twelve Cæsars, in a perfect state of preservation.

The coins used with the best effect for jewellery are the silver coins of Greece, with gold settings.—*Journal of Applied Science.*

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CONTENTS.

	PAGE
HOROLOGY	83
THE END OF A FALLACY	84
CLOCK FOR THE NEW GAS WORKS AT LEICESTER	84
QUERIES AND ANSWERS	84
PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS	85
ENGLISH WATCH COMPANY, BIRMINGHAM	85
FINISHING AND LACQUERING THE BRASS SURFACES OF TIMEKEEPERS, ETC.	86
TRADE RECIPES, &C.	87
WEIGHTS AND MEASURES ACT, 1878	87
THE SILVER TRADE	83
WATCHMAKERS & JEWELLERS' PROTECTION SOCIETY	88
THE JEWELLERY TRADE IN 1879	90
HINTS TO REPAIRERS	92
THE MANUFACTURE OF DIAMONDS	92
TECHNICAL EDUCATION	93
MONTHLY RECORD OF BANKRUPTCIES	94
PATENTS	94
GREENWICH CHRONOMETER TRIALS, 1879	95
EXCELSIOR STEAM WORKS	96
DIRECTORY	ii
ADVERTISEMENTS	i-x

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HOROLOGY.

(Continued from page 70.)

XLVIII.—MEASUREMENT OF PINIONS.

THERE is probably no part of watch-making, excepting the escapement, that is susceptible of more careful adjustment than the depthing of the wheels and pinions; for the regularity in the going of the watch depends as much on these depthings as it does on the careful adjustment of the parts comprising the escapement, and it matters little how well shaped or how well-finished the teeth of either wheel or pinion may be, if the depth is not correct the result will be very unsatisfactory. Then, again, if the size of the pinion is out of proportion to the size of the wheel, the workman will assuredly find it an impossibility to obtain a correct depth. For that reason we have prepared the following table of pinion measurements, which, if exactly followed, will enable any workman to determine the exact size of the pinion wanted. We have purposely withheld a description of the mode of calculation by which these tables have been obtained, for the reason that the majority of repairers have not the education required to fully understand it, and it would, therefore, seem dry and uninteresting. It must be understood that the measurement of the diameter of a pinion, in this table, is constantly in the wheel by which it is driven. A pinion of 6 leaves must have the diameter of 3 teeth, measured in the wheel, from the very top of the first tooth to the top of the third tooth; for clocks, it must have 3 full teeth—that is, from the outer side of the first tooth to the outer side of the third tooth. A pinion of 7 leaves must have the diameter of 3 full teeth; for clocks, 3¼ full teeth. A pinion of 8 leaves must have the diameter of 3¾ teeth, measured from the tops of the teeth; for clocks, 4 teeth, also measured on the tops. A pinion of 9 leaves must have the diameter of 4½ teeth measured on the tops of the teeth; for clocks, the same. A pinion of 10 leaves must have the diameter of 4 full teeth; for clocks, the same. A pinion of 11 leaves must have the diameter of 4⅓ full teeth; for clocks, the same. A pinion of 12 leaves must have the diameter of 4½ full teeth; for clocks, 5 full teeth. A pinion of 13 leaves must have the diameter of 4¾ full teeth; for clocks, the same. A pinion of 14 leaves must have the diameter of 6 leaves, measured on the tops of the teeth; for clocks, the same. A pinion of 15 leaves must have the diameter of 6 full teeth; for clocks, 6⅛ full teeth. A pinion of 16 leaves must have the diameter of 6⅛ full teeth; for clocks, 6¼ full teeth. There is an instrument sold in the tool shops named the Proportion Circle, which has for its object the measurement of the diameter of the pinion by the size of the wheel, and *vice versa*; but this tool is only of use when new, for they are very apt to get bent, and otherwise out of order, which condition renders it iseless—for where there is such precision required, as in he measurement of a pinion, this cannot be tolerated. But if ho workman will take the trouble of committing to memory he few directions given above, it will repay him by having iot only an instrument always at hand, but one that will never get out of order and always be correct.

(*To be continued.*)

THE END OF A FALLACY.

THE tenacity of life that exists in a vested interest has passed into a proverb, and this altogether irrespective of whether the interest is contributory to the public welfare or not,—only let an interest or a belief be of old standing and deeply rooted, and so surely it may be assumed that it will die hard.

Although much can be said in praise of this characteristic of our national temperament, yet, on the other hand, we think it may be cogently urged that its operation in respect to general trade has been in many branches of industry a serious hindrance to commercial progress.

Only recently a statement has been the round of the papers to the effect that a large order for a specially elaborate lock that is a favourite in Spain and Portugal, had failed to be executed in England, where it was offered, because the workmen could not get out of the rut in which they had been brought up, and make an article that differed from their traditional models. Instances of a similar kind might readily be multiplied; it is, however, sufficient for our purpose to indicate the existence of this prejudicial bias that it may be seen how it illustrates the demeanour of the watchmaking trades of this country towards a change which we have long seen to be inevitable, and have from the first advocated in this journal.

We refer now to the wonderful, the dogged and unreasoning tenacity with which the English trade, almost without exception, has stood by the fusee and chain in the construction of pocket watches; stood by it regardless of the advantages of simplicity to be gained by its abandonment; stood by it indifferent to the demonstrations afforded by the manufacturers of other countries; stood by it, we repeat, and, shutting their eyes to these things, they have gone to sleep, allowing others to play the game, until now the awakening comes upon them as a startling shock for which they were wholly unprepared, and yet we would fain inquire, Why should they be startled? The facts have been there, and the evidence has been accumulating, but all has been practically unheeded by those who after all were most vitally interested. So far, however, as our readers are concerned, we have done our duty in the matter. In July, 1878, we published an article entitled "New Ideas in Watch Manufacture," and at the same time we reprinted in extenso a pamphlet, "A Familiar Discussion on the Going Barrel and the Prejudices that Exist against it," addressed to practical watchmakers by the English Watch Company of Birmingham, intending by this step to open up the question, and have it fully discussed in our pages, but the interest of the trade in the subject was not sufficient to initiate the interchange of opinion we then invited. Recently, however, unmistakable signs of an awakening have shown themselves.

Mr. D. Glasgow—well known as an excellent and practical workman—some months ago in the pages of our esteemed contemporary, the *Horological Journal*, described a going barrel watch he had made, and with something like the surprise of disappointment confesses that "it goes as well as any fusee watch of the same class;" but the most emphatic utterance is that of Mr. E. D. Johnson, who from his position as an Exhibition Juror has had opportunities of comparison that fall to the lot of few, and who now declares* in the following emphatic language, his mature judgment that the fusee is but "an expensive adjunct, which could well have been dispensed with, and would have been, if common sense had been permitted to rule."

Mr. Johnson further states that "the prime mover which must now come into use in England as well as it has in all other manufactories of the world, is the going barrel." We cannot help observing that the arguments used as stepping stones to reach this position are almost identical with those in the pamphlet referred to. The question was therein most ably brought before those interested by the English Watch Company, and in the products of their factory they have practically demonstrated the truth of their assertions. There is no disputing the weight and influence of such statements from such a source, at the same time we must give honour where honour is due; and we feel it incumbent to point out that the credit of being pioneers of the going barrel in this country, both as regards simple construction and uniform and systematic production, belongs to the English Watch Company, who for nearly seven years have been fighting the battle of progressive ideas in watch manufacture, and who from the commencement of their operations to the present hour have staked their business reputation and their commercial success upon principles which are now being freely recognised as true, and which ere long are bound to be universally accepted and acted upon by the trade.

We rejoice alike for the credit of our country and the prosperity of the watch trade that it is so, for if one thing is clearer to an impartial observer than another, it is, that not only this question alone, but every other that concerns the simplification and the improvement of our English watch, and the abandonment of the hindrances that stand in the way of a vastly increased production, must be fairly faced and firmly dealt with, or some fine morning it may come to pass that the great bulk of English manufacturers will find themselves left behind in the competitive race, and, what is worse, they will have no one but themselves to thank for being in that unenviable position. It is no use wailing about foreign competition, we must grapple with it bravely, put our shoulders to the wheel, and of the result we have not the faintest doubt.

CLOCK FOR THE NEW GAS WORKS AT LEICESTER.

A LARGE new chiming clock is being erected now at the new gas works belonging to the Leicester Corporation. It strikes the hours upon a bell 11 cwt., and quarters upon two others. The time is shown upon four five-feet dials, which are glazed with white opal glass for illumination; apparatus is attached to the clock to put the gas up and down for winter and summer. The movement is fitted with all the latest improvements; it has a double-three-legged gravity escapement, with a compensated pendulum of 2½ cwt.

The whole has been constructed and erected by Mr. Smith, Midland Steam Clock Works, Derby.

QUERIES AND ANSWERS.

R. H. THOMAS, Fermoy.—Bath for Electro-plating.—Use a wooden vat lined with best Portland cement, or better still an enamelled iron tank, as the best electro-plating establishments use.—W. H. B.

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* "The Fusee and Farewell to It." *Horological Journal*, Dec., 1879.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTROPLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. IX.

(*Continued from page* 71.)

To Charge the Battery.—We take as a standard an element 10 inches in height, and ·6 inches in diameter. First half fill the stoneware pot with water, add 7 ozs. of sulphuric acid at 66° (oil of vitriol) and 1 oz. of amalgamating salt; or the zinc may be amalgamated with metallic mercury, after it has been cleansed in diluted sulphuric acid, by being dipped into mercury, or rubbed over with this metal by means of a scratch brush of brass wire. This method takes, however, more time, is more difficult to execute, and does not give such satisfactory results as the amalgamating salt. The salt reaches every part of the zinc, acts evenly and only on the part immersed in the liquid. Tho latter is a great advantage, because if the mercury comes in contact with the copper bands they are liable to break; besides, tho manipulation of mercury is always injurious to the operator, and should on that account never be employed where its use is not an actual necessity. Put the zinc cylinder into the stoneware pot, then introduce the cylinder of carbon into the porous cell; fill the empty space between the carbon and the sides of the cell with nitric acid, at from 36° to 40° Baumé; finally place the porous cell thus filled into the centre of the zinc cylinder. This will cause the liquid in the outer vessel to rise nearly to tho top of the zinc cylinder, so that the liquid will be level.

To Connect the Elements.—When several elements are to be connected, they are first placed near each other, without touching, and the first carbon or graphite is left free for the attachment of the anode. The ribbon or band of the first zinc is fixed between the jaws of the brass binding screw and the carbon of the second element, and so forth, until the last zinc is ready to be connected with the object to be electroplated.

To Start the Battery.—The battery is in action and furnishes electricity as soon as the circuit is closed; that is to say, when the conducting wires, starting one from the carbon and the other from the zinc, are put into communication, whether by direct contact or through the medium of a conducting liquid. It sometimes happens that batteries which appear to be well-constructed and in good order do not work. This is generally due to some foreign substance preventing the conductibility at the points of contact, or to the copper band of one zinc resting upon another zinc. Before using a battery always try if the current escapes well from both extremities. For this purpose present the point of the negative wire to the carbon of the other end, and a spark should immediately ensue. The same experiment being made with the positive wire against the last zinc, another spark should be produced; or it is still more easy to have the two ends of the wires made to rest at a short distance from each other upon a piece of carbon, or upon a file, and then rubbing with one wire while the other remains in contact. Numerous sparks will immediately appear. When one element of a battery is wrongly put up, discover the defect by successively presenting the end of one of the wires to the carbon of each element, and that which does not produce any spark belongs to the defective element. A frequent cause of stoppage is also too much porosity in the cells, because the solution of zinc, which penetrates in that case, deposits upon the carbon a whitish crust, preventing any further action. It is then necessary to change the cell and to scrape off the crust entirely from the carbon. This generally happens only when the battery has been working several days without the addition of fresh liquor, or when the acid is in excess. Tho battery will also cease working when too much zinc is dissolved, because the sulphate of that metal, not having sufficient water to remain in solution, crystallizes upon the sides of the zinc cylinder, and prevents any further action of the acid. The acid solution must then be thrown out, the zinc thoroughly cleaned, and a fresh solution substituted. Laminated zinc is preferable to that cast in a mould, because the latter is not so homogeneous, is more rapidly corroded, and sets easily.

To Keep the Battery in Order.—Every twenty-four hours, and sometimes oftener, the losses of batteries must be made good by adding, without taking the elements apart, about two tea spoonfuls of amalgamating salt, and twice as much of sulphuric acid to tho liquor in which the zinc plates are immersed, and stirring with a glass rod. Nitric acid, to replace that evaporated, is put into the porous cell. In this manner the battery may be kept in action for five or six days; but after that time it is necessary to take the battery to pieces, the old liquors are thrown away, and the battery is charged afresh. Although amalgamated zinc is scarcely affected, even by a very acid solution, it is nevertheless desirable to take the battery apart every evening, when the two poles are not in connection by direct contact or through a conducting liquid. Proceed as follows:—All the binding screws are let loose and cleaned if necessary, the cylinders of carbon are removed and, without washing, deposited in a vessel especially for their use, the porous cells are removed, and their acid poured into another special receptacle. These cells are not washed either. The zincs are withdrawn from the acid liquor and placed in an inclined position upon the edges of the stoneware pot, and the battery is again set roady for work by a converse manipulation.

Important Hints relating to Batteries.—It is always well to have a spare battery at hand, or at least duplicates of the most fragile parts of an element. Batteries must be kept in a place where the temperature does not greatly vary. Frost arrests their action, while great heat increases it too much and shortens its action. It is well to place them in a box or cupboard at about tho height of the waist, so that they can be readily manipulated. This box should have means of ventilation, in such a way that the air coming in at the lower part will escape at the top through a flue and carry away with it the acid fumes constantly disengaged. If practicable, it is best to keep the batteries in a room separate from the one containing the baths and the metals to be operated upon, as these are easily injured by acid vapours. The galvanic current may be conducted into the workroom by wires passing through holes in the wall, and covered with gutta-percha. (*To be continued.*

ENGLISH WATCH COMPANY, BIRMINGHAM.

In consequence of information which reached our office, we stated in our last that the English Watch Company had opened a branch at Holborn Viaduct, London, presuming it, of course, to be the English Watch Company of Birmingham, so well and favourably known to the trade; but such is not the case. It appears that some unprincipled persons have had the audacity to appropriate the style of that firm and attempted to trade on their well-earned reputation. Proceedings have, of course, been taken against the persons concerned, to prevent further infringement. We regret that we should have been the means of spreading this erroneous information, the more so, as the English Watch Company, worthy champions of the English watch trade, deserve every consideration.

FINISHING AND LACQUERING THE BRASS SURFACES OF TIMEKEEPERS, ETC.

THE custom of lacquering the brass work of our larger, and also moderately-sized timekeepers and machines, or instruments of a similar character, cannot be too highly recommended; and this practice may also be applied with great benefit to many of the brass tools in use in our business. When properly executed, these brass surfaces are coated with a thin covering of a substance nearly as hard and smooth as polished glass, which prevents oxidation and tarnish, and renders any dirt or other foreign matter which may collect on the lacquered surface to be easily and expeditiously removed. Of late years it has become common to plate many articles connected with our business with nickel, and for steel articles it has proved to be very suitable. So far as protecting the surfaces is concerned, it is just as good for brass; but the white colour which it gives is not always desirable. Nickel-plated marine chronometer boxes which have been in use for a short time never look so clean as those which have been well lacquered. They possess a kind of dirty white appearance, which is as unpleasant to the eye as a piece of polished silver that has become dirty, and contrasts as unfavourably with a well-lacquered box as a piece of polished silver that has been finger-marked does with a finely-polished piece of gold. But while advocating a more extended and judicious use of lacquer, we are not to be considered to be unfavourable to the use of nickel in instances where the white colour is not considered objectionable. Lacquering, although an exceedingly simple operation, is seldom executed in a proper manner; and it is our object to give some plain, practical directions that will enable anyone, after a little practice, to finish brass surfaces in the most approved manner, and cover them with a pleasing and lasting protection.

The base of all lacquers, as is well known, is a resinous substance, called stick-lac; it is in the form of small rough brown-coloured lumps, about the size of the point of the thumb, and is found attached to the branches of a certain kind of tree that grows in Assam, in the East Indies, and when bought at the stores a small piece of the wood of the tree is found in the centre of the lump, from which it derives its name—stick-lac. Seed-lac is the stick-lac broken up into small pieces, and appears in a granulated form. Lump-lac is seed-lac liquefied and formed into cakes. Shellac is the purified lac, which is made by heating seed-lac in strong canvas bags. The pure liquefied lac drops through the pores of the canvas on to a flat surface, which produces the familiar substance known as shellac, while the twigs of wood and all the larger lumps of insoluble matter are left inside the canvas bag. In making good lacquer it is best to use the stick-lac as it comes from the tree, because in its other forms it is frequently adulterated with some of the softer and cheaper kinds of gums of the same colour, and which is very injurious to the lacquer, rendering it soft and easily rubbed off. The stick-lac should be broken into as small pieces as possible, and then dissolved in 95 per cent. alcohol in a well-corked bottle, occasionally shaking the bottle, and after a few days strain the liquid through a fine linen cloth or some similar substance. The liquid strained off will be of a deep red colour, but in this state it will be found to be unsuitable for many purposes owing to the darkness of its colour, as in many instances it is not desirable to change the colour of the work being lacquered. Although a very slow and tiresome process, the best way to take the colour out of the lacquer, and at the same time to retain its original hardness, is to expose the bottle containing the liquid to the rays of the sun for a sufficient length of time. White lac can sometimes be purchased that has had the colour taken out of it by a chemical process, and for many purposes it does very well; but lacquer made from this white lac is never so hard, nor stands so well as lacquer that has been made from stick-lac dissolved in strong alcohol, and the colour taken out by the rays of the sun. In some instances, however, it is desirable to change the colour of the brass a little, and the deep red-coloured liquid will be found to be suitable for some purposes, either alone or mixed with a decoction of gamboge or annatto, the former giving a yellow, and the latter an orange colour. In order to produce a golden colour, about two parts of gamboge are added to one of annatto; but these colouring substances may be separately dissolved in the tincture of lac, and the colour required may be adjusted by mixing the two solutions in different proportions. There are sundry other materials from which a due mixture will produce like colours, such as turmeric, saffron, dragon's blood, etc., but we consider gamboge or annatto to be the best colouring for the lacquer required in our business. Some kinds of the cheap prepared lacquers are almost entirely composed of colouring substances, with very little lac for a basis, and this is one reason why work lacquered with it becomes in a short time dull and streaked in appearance. The main secret of the fine hard lacquer which we see on some old clock dials, on the back frame and pendulum bobs of old English spring clocks, and on old astronomical instruments, is due to the fact that the lacquer was made from stick-lac as it was taken from the tree, and the softer gums, necessary for colouring, were used but sparingly.

The preparation of surfaces previous to laying on the lacquer is one of much importance, for any defect in the finish of the surfaces will show through the lacquering. In the common brass-finishing business, much of the brass work is prepared for lacquering by dipping it into a mixture of nitric and sulphuric or other acids; but we do not consider the question of dipping to come within the scope of this article, as it is only very fine surfaces we propose to deal with. In all kinds of work of this class, whether it be flat or circular, the main object in view should be to have the grain of the polish as regular as possible. Fine polishing is best and quickest done by using bluestone, or Scotch stone. Bluestone is imported from Germany, while the Scotch stone, as its name implies, comes from Scotland; both kinds may be had at almost any of the material dealers. There are various qualities of the Scotch stone, but those pieces that are of a dirty white colour, and having yellow or blue speckled marks through them are the softest and cut the smoothest. Either bluestone or Scotch stone can be cut into strips of the necessary shape by means of a saw, and ground perfectly flat afterwards on a piece of sandstone with water. With one of these pieces, and a plentiful supply of water, all the file marks should be polished out of the brass, and the stone should be handled precisely in the same manner as a smooth file is used; and if any small particles of brass should adhere to the stone, they must be rubbed off by means of another piece of stone, else the brass particles will be found to scratch the work. Of late years the practice of polishing fine brass work without using polishing stones has become quite common among a certain class of workmen; and probably the necessity for using water with the stone is one reason why it is omitted; but we have never tried any other method of polishing by which we could do first-class work quicker and better than by a judicious use of polishing stones to prepare the surface for the final operation.

(*To be continued.*)

AN International Exhibition will be held in Rome in 1882.

TRADE RECIPES, &c.

To Solder Tortoise Shell.—Bring the edges of the pieces of shell to fit each other, observing to give the same inclination of grain to each; then secure them in a piece of paper, and place them between hot irons or pincers; apply pressure, and let them cool. The heat must not be so great as to burn the shell; therefore try it first on a white piece of paper.

Polishing Vulcanite.—Remove scratches with a smooth wet water of Ayr stone, and then polish in the lathe with fine pumice and a stiff brush. After washing the pumice off, polish it with whiting and soft brush. The mathematical instrument makers treat it as brass; that is, for flat work they first use water of Ayr stone, and then rottenstone and oil. Turned work is polished in the lathe with rottenstone and oil, taking care not to use too high a speed, which would heat the work. Some use lampblack and oil to finish with where a very high polish is wanted, or the bare palm of the hand, as in getting up silver plate. Chain and ornament makers use circular buffs for their flat work, made of sea-horse leather, and for work of irregular forms, buffs of calico. A number of pieces, 12 inches in diameter, are screwed together between flanges, like a circular saw spindle, and used with rottenstone, always taking care not to heat the work; brushes are not at all suitable for it.

Silvering for Barometer and Thermometer Scales.—Take $\frac{1}{2}$ oz. of nitrate of silver; dissolve in half a tea-cupful of cold water; add $\frac{1}{2}$ lb. of cream of tartar, with $1\frac{1}{2}$ lb. of common salt, beaten or ground fine. Mix and stir well together, adding water until it attains the consistency of a thick paste. Now lay the scale on a board, the brass or copper being previously well cleaned and cast off from fine sand-paper; rub the silvering on with your hand until it attains the appearance of silver, which will be a minute or so; now take the work off the board and rub a little wet whiting over it, wash out in clean cold water, and dry in saw-dust. If varnished with a thin coat of white hard varnish, reduced in spirits of wine, this will last for years. The above quantity of silvering used with care will silver six dozen brewers' thermometers, 14 inches long.

Uralium, a New Metal.—As far back as 1869 the author discovered this metal in commercial platinum obtained from Russian ores. Next to silver it is the whitest metal known; its malleability is as great as that of the purest platinum, but its ductility is much greater, and it is almost as soft as lead. Its melting point lies near to that of platinum, and it is not volatile. Its specific gravity=20·25, and its molecular volume, like those of osmium, platinum, and palladium, is 6·25. Its atomic weight has been found 187·25. In its chemical properties it is difficult to distinguish from platinum.—*A. Guyard.*

The Galvanic Oxidation of Gold.—Grotthuss, says M. Berthelot, in *Comptes Rendus*, in his classic experiments on the decomposition of water by the galvanic pile, remarked the solution of a gold wire employed as the positive pole in sulphuric acid traversed by the current. This interesting fact was pointed out to me by our venerated dean, M. Chevreul, who asked me if such an effect might not be due to the formation of per-sulphuric acid. It was for the purpose of replying to his question that I made the following experiments:—I first repeated Grotthuss's experiment, which is precisely as he described it. The sulphuric acid (at 10 per cent.) becomes yellow, and rapidly dissolves the gold wire. The dissolved gold can easily be detected by means of stannous chloride. A portion is reprecipitated upon the negative pole.

Nitric acid, under the same conditions, equally attacks the gold, and becomes filled with a violaceous precipitate (gold or aurous oxide?), which remains in suspension. Dilute phosphoric acid, on the contrary, does not appreciably attack gold, even under the influence of the galvanic current; nor has potass any greater action. That gold is attacked by sulphuric and nitric acids is not due to ozone; for oxygen charged with ozone remains without action upon gold in the presence of water, whether pure or charged with sulphuric or nitric acid.

Nor does persulphuric acid (prepared by electrolysis) attack gold, even if it contains in addition a portion of oxygenated water.

It follows from these observations that the attacking of gold takes place solely from influence of the galvanic current, and at the contact of the electrode with the electrolysed liquid.

WEIGHTS AND MEASURES ACT, 1878.

FROM correspondence which has reached our office we find that many in the trade are still under the impression that the above Act is to remain a dead letter, but we can assure them that such is not the case; on the contrary every clause of it will be duly enforced. The inspectors are extremely busy, and numerous cases have already been proceeded with, ending always with the imposition of a fine. We hear that on a single day fines to the amount of £110 were imposed on the Surrey side of the Thames. Many find it hard to believe that they should be subjected to penalties for doing that which they and their forefathers had been doing from time immemorial with perfect legality. The Act is certainly far from perfect, and may be obnoxious to many, but now that the law is in force it must be simply obeyed; opposition comes too late. It is certainly a pity that an Act tampering with time-honoured trade habits should be passed without consulting those principally affected by it; however, as it is, the Decimal System has become compulsory for all traders by troy weight. The system has also many advantages, and when once familiar with it we should not care to return to our old method. The younger generation will grow up with it, and those who do not care to polish up their knowledge of decimals, left to rust since their schooldays, have now a perfect and ready assistant at command in the shape of "A Manual of the Decimal System," by W. J. Abbott. We may at once say that this indispensable calculator has been compiled with the greatest care, not by an accountant who simply manipulates a series of figures, but by an experienced tradesman, who has made the system a study, and whose business knowledge enables him to provide what experience taught him was necessary for the special trades of the jeweller, silversmith, and pawnbroker.

The work is most comprehensive and easy of access; the author being no doubt well aware that a book of this kind to be useful must be so arranged that any desired information can be got at without loss of time. It explains all the principal rules in decimals; with examples of decimal calculations, tables of values of gold; rules for mental calculations, a nomenclature for the new troy bullion weights; and the application of the system to diamond weights; with tables of values of any weight of diamonds from ·0001 ounce to 10 ounces, at £1 to £10 a carat; also a ready reckoner from ·001 ounce to 250 ounces, at 2s. to £5 2s. an ounce.

All the calculations are well authenticated, so that they are perfectly reliable. The book is printed in good clear type, and strongly bound.

It will certainly prove a most valuable assistant for the easy and successful application of the decimal system to our trades. We recommend it without hesitation.

THE SILVER TRADE.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

SIR,—Your New Year's number would be incomplete without reference to the prospect of reform in the Silver Trade. The fact that 1879 has been remarkable for a report of a Select Committee of the House of Commons condemning the duties upon gold and silver plate is, of itself, a subject of congratulation. Whether the coming year, with its many responsibilities, will find the Government willing or able to comply with the recommendation of the Select Committee as yet it is impossible to foresee. However, it is a matter of serious interest to manufacturers and workmen, and there should be no delay in pressing the claims of the trade upon the attention of the Chancellor of the Exchequer. Suffice it to say that a postponement of the abolition of taxation means simple ruin to business. Retailers now know that the tax is to come off. But it is equally uncertain whether a drawback will be allowed upon "stocks in hand." This uncertainty will result in a general indisposition to purchase. Already this determination on the part of shopkeepers has made itself felt, and manufacturers are finding, to their cost, that they would have done better if the tax had been taken off in April, 1878, when, as is now generally known, Sir Stafford Northcote was prepared to abolish it. The folly of the St. James's Hall meeting has now been made manifest, and the trade are beginning to see that the "high estimation" in which British silver plate is held abroad may be very pretty as a sentiment, but that, taken by itself, it is but little productive.

Workmen, who can scarcely be expected to take a sentimental view of such a question, complain bitterly of the depression in the silver trade, rightly ascribing the greater part of that depression to the unjust laws to which their particular craft is subjected. The fact is, that they are fully aware that the "high estimation" sentiment is simply a craze. Foreigners ridicule our silver plate. There is no disguising the matter. Buy it they do not—they will not. No one can expect them to buy it. Our own people complain of its inartistic character, of its heavy, graceless design, and of its monstrous price when compared with the value of the raw material. Thus it is that reform is so sorely needed. And why should there be two opinions as to the nature of the reform? History speaks with no uncertain voice as to the beneficent effect of freedom of trades from all taxation and other hindrances. It is not as though we had no precedents to follow. The glass trade is an all-sufficient precedent. And there are dozens of others. All prove that what is wanted in the silver trade is freedom—viz., the abolition of taxation, and of the still more pernicious system of compulsory hall-marking. Now, there is nothing frightening in this. The voice of the reformer is, as we well know, always at first alarming. Change is distasteful to most people, but after a while the reformer's voice ceases to alarm; a little later on, opposition ceases—reform is accomplished. There is a little flutter as everyone hastens to comply with the new law, and in a few weeks, at most, it would be as great a sin to recreate as previously it had been to destroy. A case is before us now, fully proving the proposition. A few weeks ago it was found that we all had to adopt the "Weights and Measures" Act. Some members of the trade came to me in a great state of consternation. They were quite ready for another St. James's Hall meeting, prepared to vote for the "high estimation" of ounces, pennyweights, and grains. However, they have all quieted down, and now we are as accustomed to decimals as though we had had them in use all our lives. And so it will be when the happy time arrives when we shall be able to work at our respective trades in peace, and with no fear of Goldsmith's Hall before our eyes. In one month after the abolition of compulsory hall-marking, the man who desired to reimpose that venerable institution would be called "an agitator," and there would be a St. James's Hall meeting to protest against any change. Its immediate effect would be to improve the character of our productions. Some dishonest men, of course, would be found ready and willing to cheat their neighbours. There are plenty of such persons in every trade—only a few days ago I found my Christmas turkey stuffed with barley-meal for the sake of a few ounces of false weight. But we are not all rogues. Surely we silversmiths are as honest as other men, and may we not be trusted by the law in common with other men? I maintain that the silver trade will get on as well without compulsory hall-markings as the gold trade, and that, as in the gold trade so in the silver trade, the absence of all trade hindrances will result in a development of design and execution which will cause our productions to compare favourably with those of our foreign rivals. If I be asked upon what I ground this opinion, I point to the jewellery trade. It enjoys absolute freedom. The ports are open, and tons of foreign jewellery can be imported without payment of a sixpence of duty. Does it come? Turn to the Board of Trade Returns, and see. A little from Germany—a little from France—a still smaller amount from Italy—a mere trifle from Denmark. And why? Because English jewellers know that they must be ever on the look-out, so to speak, ever improving; opposition is close at hand, and thus they keep the foreigner out by the excellence of their own productions. If jewellers had been protected from foreign competition, like silversmiths, I wonder what sort of jewellery we should be making! I suppose bright burnished die work, such as was made some half century ago, instead of the charming work which is now being made, and which it is not idle to say *is* held in "high estimation" abroad, for the best of all reasons that foreigners buy it, wear it, and value it.

With your permission, I will continue this letter in February.

I have the honour to be, Sir,
Your obedient servant,
EDWARD J. WATHERSTON.

Pall Mall East, London, Jan. 1, 1880.

WATCHMAKERS & JEWELLERS' PROTECTION SOCIETY.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

SIR,—It has recently occurred to me that a letter to the trade, published through the medium of your journal, might be the means of forming an association for the purpose of protecting us against a practice which has of late, I believe, greatly increased, viz., that of unlicensed persons selling silver articles contrary to law. I do not for a moment uphold the license, but as every trade more or less encroaches upon some other, I think it only fair that all should be taxed alike. Since the introduction of silver jewellery in its present form, many persons without licenses have kept and sold articles in silver over weight, besides the supplying of small silver goods by ironmongers (sugar tongs, butter knives, &c.), stationers (medals, pencil cases, &c.), chemists (scent bottles, &c.) In many instances I have no doubt but that this infringement of the law is known to some resident silversmith, but the unpleasantness of turning individually "informer" prevents any action being taken; if, however, a society could be formed, having the protection of our trade for its business, most of these cases could be brought to the knowledge of the society, and action taken as might be decided upon.

Almost every business is thus protected, and I cannot see why ours, which is generally carried on by men of intelligence and means, should be the exception. If you, Mr. Editor, can suggest any plan, I shall be glad to see your remarks, and I shall be happy to correspond with any in the trade upon the subject.

I remain, Sir,
Yours faithfully,
J. S. Greenhow.

Chelmsford, Dec., 1879.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Mr. Editor,—I was very pleased to read the letters which appeared in your journal in reference to a Watchmakers and Jewellers' Protection Society. I am not given to grumbling, but really things are getting so bad that I am afraid of losing my living altogether. I can honestly say that I am a thorough and hard-working watchmaker, and not afraid of competition in a fair market. I keep a small but sound stock of watches and clocks, but my chief support are the repairs; in fact, the hawkers who pay no license and no rent do not give me a chance. People are fond of bargains, and they think they *do get bargains*; they tell me they can buy a watch for 20s. for which I am obliged to ask £2 2s. Of course, I know they cannot do so, but imitations are now so well got up that even better judges of watches than the ordinary public get taken in. If I choose to keep the same rubbish I could do the same, but I have a reputation to lose; besides, my own conscience will not allow me to sell a watch as *good* when I know that it is not so beforehand. I think it is very deplorable that it should have come to this, and that a man cannot do business in an honest way. The man that sells his got-up watch pockets the money and most likely never returns to the same place any more, so his responsibility is at an end. It is *me* that gets the worst of it; he prevents me from selling my genuine article, and as soon as his sham breaks down, which happens generally soon enough, I am supposed to put the thing in going order—no easy matter when the article was only made *to sell*—and as the watch cost only a trifle, I am, of course, expected to do the job for a mere nothing. Now for my part, I would not take in these jobs if I could help it; but I know if I refuse somebody else will do it. Here is where the benefit of such an association would come in. *Let us all refuse to repair rubbishing watches, and we shall not only get rid of troublesome and unprofitable repairs, but also of bad watches.* Unity is Strength is an old motto, but remains still true. I as an individual am perfectly powerless, but united with my fellow-workers I should be all-powerful, and no longer at the mercy of any sharper that chooses to come and take the bread out of my mouth. Card enclosed.

I am, Mr. Editor,
Yours sincerely,
Fairplay.

Blackburn, Dec. 10, 1879.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Dear Sir,—Nobody can help being aware that much of the business justly belonging to the watchmaker and jeweller has gone into other channels. Of course we are at a great disadvantage. We depend for a living upon the sale and repairs of watches and jewellery, have licenses and skilful labour to pay, while the ironmonger, stationer, draper, etc., makes it simply an addition to his business; he has no extra expenses, but makes an extra profit at our expense. They are in most cases unacquainted with the articles they sell, they take no interest in our special trades, and are, therefore, willing to sell anything and everything as long as it offers them a profit. How can we remedy this would be a fit problem for a Watchmakers and Jewellers' Society, and I should be glad to contribute my share towards such an object.

M. S.

Glasgow, Dec. 20, 1879.

[We are glad to notice that the trade is at last becoming alive to the importance and necessity of such an institution as a Watchmakers and Jewellers' Protection Society We have often pointed out the benefits which such an association would confer on the precious metal trades, but the trade has generally shown such apathy that any further steps were at once checked. The last few years' depression has, however, led many to reflect, and we have certainly strong evidence that such a movement would meet with general approbation and support.

We are certainly all agreed, to whatever branch of these trades we belong, that there are many things which act injuriously on our interests, and that some measures must be taken to remove these grievances. Our Blackburn correspondent truly says our interests can only be defended by combined action; individual efforts are powerless. What is more natural than that we should unite and plead our common cause? When we speak of a Protection Society, we do not mean anything which would be contrary to our free trade principles; we want to strengthen action and not hamper it our object is to secure fair play, equal liberty and advantages for the precious metal trades as other trades enjoy We do not want protection against the public, but agains those who illegitimately and often fraudulently usurp the business which by right belongs to the watchmaker and jeweller; nor do we intend to put any impediments in the way of open and fair competition. The latter would alway be keen enough among *bonâ fide* tradesmen, so that the public need not fear that the watchmaker's, jeweller's, or silversmith's profits would become too large.

Mr. Greenhow rightly states that we have to shut our eyes to frauds which most injuriously affect us, because "no one likes to turn 'informer' individually." The Revenue officers are simply nowhere. Instead of hunting up those that sell goods with *forged hall-marks, trade-marks, and manufacturers names*, and that without a license, they worry respectable tradesmen who might possibly not be over particular in these hard times, and sell an article slightly beyond the power o their license. They afford us no protection. To act as genera prosecutor would be one of the functions of the association

A few rigorous prosecutions would soon diminish the number of those who make free with the hall-mark, and the reputations of honest jewellers and watch manufacturers. The complaints of English watchmakers that their names are made use of to sell inferior foreign articles would rapidly cease. At present they are powerless; prosecutions are too expensive for their private purses; but a mite, if contributed by all interested in the welfare of our trades, would be sufficient to procure that protection.

As far as we are concerned we shall spare nothing which might further the interests of the trades with which we have the honour to be connected. Our pages and our pen are at the command of our readers, and we shall also gladly bear the expenses which the preliminary steps of such an association might entail. All we demand is the hearty co-operation of all those interested, each according to his power. Let every one have his say and we shall soon be able to get something into shape. Those desirous of taking an active interest in the movement will kindly communicate with the editor. A preliminary meeting might then be arranged for the formation of a provisional committee.—Ed.]

THE JEWELLERY TRADE IN 1879.

"THERE is little doubt," says the *Birmingham Daily Gazette* "that the severest disappointment the Birmingham jeweller and probably every other jeweller has experienced was that of the first two months of the present year. Accustomed as he had been, like his brother manufacturers in other trades, to an increasing competition and decreasing returns, he had ventured to hope, after the improving autumn sales of 1878, that at last the long lane of depressed trade was beginning to have an upward turning. Never were hopes more grievously blighted. Not only did matters sink down to a lower level than before, but the best houses, who throughout had kept up a high-class business, though with increasing difficulty and expense, found that the appetites of purchasers had entirely palled. The fact is that this trade was really reviving, when the Glasgow Bank failure, an unmeasured disaster in itself, was followed by a series of other failures, which together only began to be felt in their full force at the beginning of the present year. Such disasters, coming after a period of good trade, must have produced serious disturbance; but coming as they did, after several lean and profitless years, they found no reserves in the purses of the people to contend against them, and so the purchase of articles of luxury like jewellery was for a time almost dispensed with.

"This was indeed an evil time for those jewellers who, not watching the course of events, had allowed their stocks to accumulate; for the relentless changes of fashion go on in bad times as well as in good ones, and it is likely that never did changes of fashion succeed each other more rapidly than during the year which is now ending. The reason is obvious. A number of anxious men, trying to sell and unable to do so, must cast about how they may tempt the unwilling fancies of buyers. So the cry is always for something new, and the restless efforts of the many bring about alterations of style more rapidly than before. One of the necessary, yet unhappy features of this change, is the displacement it often effects in workmen and manufacturers, in the jewellery trade especially. The workmen or the master, wedded to old notions or habits, is passed with a rapidity which is to him most disconcerting. A new idea, a new mode of decorating a brooch, an earring, or a locket, will in some cases transfer a whole business to a new shop for a few weeks; and this can only be remedied when the old manufacturer wakes up, and by a new mode of action in a line with public taste, begins to assert what he holds to be his rightful position. The records of the year 1879 can show several sad instances (and many more have not come to the public eye) in which worthy people have gone to the wall, or have been forced to relinquish their calling, simply because they could not keep abreast of the novel demands of the public in the various kinds of jewellery.

"We had said 'demands,' but this word does not adequately express the idea. It would have been more correct to say, 'because they had not been successful in tempting a needy or reluctant purchaser.' It has been a case of tempting the public rather than of supplying an ordinary demand. The result has been a constant cheapening process by which every style has been brought down to the level of the pocket of the final wearer. This has not been done without much serious trouble in adjustment between the buyer and seller, between workmen and employer. The skilful working jeweller accustomed to be fully occupied in high-class work, does not willingly descend to lighter and cheaper varieties of the goldsmith's art—the ordinary gold jeweller cannot without a sigh leave the more precious metal and take to rushing through large quantities of silver articles in the same time in which he would carefully finish a few gold ornaments. The silver jeweller is in dismay at the necessity he is under during these bad times of quitting even the silver brooch, and of supplying instead enormous quantities of metal-plated imitations. But this has been the experience of the year. The taste for ornament remains the same; but as the purchasing power of the people is reduced, the articles manufactured will always probably increase in number as they decrease in value.

"The most unfortunate members of the trade during the year now closing have been the dealers in and setters of gems and precious stones. The value of such commodities must fall in times of depression and scarcity, but not below a certain level, as all persons of sense are aware that the prices of these articles must rise again if they can only afford to keep them until a period of recurring prosperity has set in. Therefore sound trading in precious stones is much reduced in years like the present, all good tradesmen buying only for pressing needs, or buying at prices which have reached the lowest limit with a view to profit on the future advance. Therefore, although a large amount of feverish and speculative trading had been going on during the present and the previous year it was well known that such trading was not a genuine symptom of improvement, but rather the reverse. Many disastrous failures have testified to the soundness of this conclusion, and have proved that the wisest dealers were those who sat still and held their stocks as best they could, only supplying from time to time the reduced but legitimate demands of the working jeweller. As a consequence of this the gem-setter has had a poor year of it. With silver, or imitations of silver, all the rage, a gold brooch or bracelet being an occasional luxury among the middle, or even the upper classes, a diamond or gem-set ornament became a still greater rarity, and except in the direction of rings—where precious stones must always be largely used—the setter was in danger of finding 'his occupation gone.'

"The failures of the previous two years have probably taught manufacturing jewellers a salutary lesson. Although such failures have been neither few nor far between during the year 1879, yet they did not equal—either in importance or in consequences—those which had developed or were known to be impending during the earlier portion of the present commercial depression. A visible precaution has taken the place of the game of speculation in which so many young beginners in the trade were wont to indulge, and although it may be followed by another relapse as business improves and confidence is again restored, yet it is for the present a healthy sign.

"It may appear at first sight a singular assertion that the prospects of the jewellery trade have much to do with weather and the crops, yet when the matter is examined it will be seen that one has a great influence upon the other. It is a curious instance of the interdependence of the various classes in a highly-civilised nation like England to note the way in which the sale of jewellery is affected by the state of the weather and the well-being of the British farmer. It must be observed at once that in the matter of personal ornaments a nation in an advanced state of society must chiefly depend on itself. Its tastes, its changing moods and fancies, can only be successfully understood and appealed to by those who are living in the midst of its social life. Although, therefore, Colonial and foreign markets are catered for and more or less supplied by English jewellers, yet the mainstay of this trade is, and always must be, the home trade. The purchasers of the better class of jewellery may be roughly ranged under two heads: 1. The trading class, comprising the manufacturer, the factor, and the merchant. 2. The agricultural class, comprising the farmer, the country resident, and the landowner. Now, in regard to the first of these classes, the trading class, it was quite clear that the jeweller could expect no substantial help from that class until the long-expected, the much-discounted revival of trade had really taken place. He, therefore, naturally turned his eyes to the second, the agricultural class. It is hardly necessary to say what a disappointment awaited him there. The long rains, the sunless summer, the disastrous harvest, almost ruined the farmer, coming as the severest of a succession of bad seasons. The same facts reduced the purchasing power of the country resident; and the landowner, in most cases with a number of farms thrown on his hands, was in no mood for incurring additional expense. We can easily see, therefore, how much the jeweller might have expected from fair weather and good crops; also, how much his chances have been diminished by the failure of both.

"Yet, after all, the jewellery trade is showing slight and fitful signs of revival. It was beginning to recover in the autumn of 1878, when the Glasgow Bank failure began to reveal the wholesale rottenness of much commercial trading. It then collapsed awhile, but it was again beginning to revive in the early spring of the past year. But then the storm-cloud swept over us, and the fate of the jeweller was involved in that of the British harvest. It is now reviving again, in spite of the adverse circumstances which have twice thrown it back before, and this time it is because the general trade of the country is reviving. Will it again relapse? This is a question none can answer, but the probabilities are that it will slowly but surely improve, and so resume a normal condition of prosperity.

"The question of hall-marking has been variously raised during the year, and it will no doubt be a great advantage to the high-class jeweller, as well as to the British public, when no duty will be charged for hall-marking an article, and thus when the Government guarantee of quality can be obtained on all articles without paying a heavy fine for the privilege. At present certain classes of gold articles can be hall-marked free of duty, while others pay a heavy duty when assayed and marked by the Office. The report of the Commission on this question also brought prominently forward another point of much interest to Birmingham manufacturers. It has long been a theory of many goldsmiths that gold of 12-carat quality or under should not be called gold, but 'auriferous metal,' because only half its component parts, and if 9-carat less than half its component parts, are really gold. The theorists are prepared to insist, therefore, that gold of 15, 12, and 9 carat qualities should not be guaranteed by the stamp of the Government Office. The Parliamentary Commission on Hall-marking by a majority endorsed this view, and the publication of the report was the signal for an indignation meeting of the jewellers of Birminghan. It was urged that the price of the higher qualities of gold necessarily placed many ornaments of that material out of the reach of the toiling millions, and of many others who yet desired to possess such adornments. It was held, therefore, that the possessor of a ring or a chain in the lower qualities of gold had as much right to a Government guarantee of what he was purchasing as the purchaser of similar articles in the higher standards. It was shown, moreover, at the meeting that since the Goldsmiths' Company had been permitted to stamp these lower standards, a great impetus had been given to the trade in such articles. Thus it was argued that the arrangement to hall-mark 15-carat, 12-carat, and 9-carat gold had met a popular want, and had given public confidence to a cheaper class of jewellery, which had hitherto been sold without a reliable guarantee. In theory the upholder of the high standards only may call 9-carat gold 'auriferous metal,' and may say to the supporters of an important Birmingham industry, 'Great is Diana of the Ephesians.' But a consensus of the best manufacturing goldsmiths and jewellers goes to show that it is practically better to guarantee a lower standard of gold than the strict theorist would approve rather than that the numerous purchasers of the cheaper articles should go unprotected from fraudulent tradesmen.

"If the silver question proceeds much further in the way of jewellery it will bid fair to minimise the foregoing difficulty. Silver jewellery has become so much the rage that the lower qualities of gold and gilt jewellery have been almost squeezed out of existence in some branches. So far this is good. A genuine gold article or a genuine silver article is each good in its way, and so far as good work is connected with it the direction of taste is correct. The more people become enamoured of realities and out of patience with shams, the more chance there will be for the production and sale of personal ornaments of genuine construction and pure design.

"A review of the jewellery trade for 1879 would not be complete without a passing reference to the death of Mr. Thomas Bragg, who has been so long and so prominently connected with this great industry in Birmingham. The senior partner in a small business inherited from his father, his energy, breadth of view, quick perception, and artistic tastes—no trifling elements in the rise and progress of the goldsmith's art, with which his own manufactory was identified, and it is probable that the influence and example of the firm tended in an important degree to give tone and character to the trade.

"The Art question is, after all, the main question for the jeweller to consider. More important than hall-marking, more troublesome to many than the silver difficulty, it is the one point to which the workman and manufacturer must alike apply themselves. If the manufacturer studies and the workman applies the principles of Art in this domain of production, then the future of the English jeweller is assured. If the manufacturer is satisfied with being a copyist, and the workman is satisfied with being a drudge, a tool working to order without an idea beyond the peg of his work-bench and his week's wage, then the future of the jewellery trade is dark indeed. But there is much to show that a different spirit and desire prevails. The necessity of Art education is daily more recognised both by masters and men. The wish to get out of the old grooves into something better is evidently stronger and more earnest. The efforts of designers also, though often crude and imperfect, go upon true lines; so that while much yet remains to be done, there is enough already accomplished in this direction to enable us to look without misgiving to the future, and to trust that the jewellery trade will yet maintain and improve its position among our foremost industrial arts."

Price of Rare Metals.—Dr. Theodore Schuchardt, of Goerlitz, Germany, prepares some of the rarer metals, and charges for them the following prices:—Cerium, 20s. per gramme; lanthanum, 40s.; didymium, 30s. These are in globules obtained by electrolysis. Thorium, in powder, is 36s. per gramme.

Goldsmiths' Company's Prizes.—With a view to the encouragement of technical education in the design and execution of works of art in the precious metals, the Goldsmiths' Company resolved early in the present year to give a series of annual prizes. Some of these prizes have just been awarded by the company as follows:—Mr. W. Herbert Singer (Frome), design for a clock, £50; Mr. Henry Harvey (Chelsea), model for an altar dish, £50; Mr. Joseph Holgate (Chelsea), design for a mirror frame, £25; Mr. W. Marshall (Chelsea), model for a card tray, £25; Mr. T. Edwards, jun. (Islington), silver tankard, for execution and workmanship, £25; Mr. A. W. Austin (Stoke Newington), repousse work, £25; Mr. Deere (Islington), chasing, £25; Mr. William Richard Corke (Islington), engraving, £25; Mr. Hugh Stannus (Kennington Park Road), design for two tankards (an extra prize), £10; Mr. Christopher Smith (Wakefield), model for a cup (an extra prize), £10.

HINTS TO REPAIRERS.

(*Continued from page 75.*)

In putting in a new scape-wheel, always be particular to see if the teeth will pass fully underneath the lever or fork. The notch in the end of the lever should be straight and well polished inside, and just enough larger than the roller jewel to allow it to work freely, and no larger. The roller jewel should always be flattened on one side towards the pallet staff; then the unlocking can be done with much less lost motion or useless expenditure of power than with a perfectly round roller jewel. In putting in a new roller jewel, select one that will work freely in the notch of the fork, and have but very little play; in fact it must have just as little play as possible, and still be perfectly free. To flatten one side of the roller jewel requires two diamond laps or mills, one charged with diamond powder coarse enough to grind the jewel down sufficiently, and the other one charged with fine diamond powder for polishing.

Having selected a jewel, and put the lap in the lathe, take a small cork, wet the end of it on the tongue, then press it down on the jewel, when you will find the jewel sticking to the cork. Next wet the lap, and, with the jewel in the end of the cork, press it against the face of the lap and start the lathe, moving the cork all the time while the lathe is running. Stop the lathe before attempting to remove the cork, or you may loose the jewel; then slide the cork off the lap to one side, and you will see the jewel imbedded in the end of the cork. If the jewel is ground sufficiently, about one-third of its thickness requiring to be ground away, rub the end of the cork having the jewel on it on a piece of letter paper, which will remove the dirt, &c., and still leave the jewel in the cork; put in your polishing lap, and this time lubricate with oil, and proceed as with the first lap. To ascertain if the flat is polished, wipe on a piece of paper as before, then see if it has the required polish. Clean the jewel with alcohol, and then cement it in the roller with shellac. If the roller is very thin, or the jewel fits it rather loosely, file up a brass pin the size of the hole, then file away two-thirds of its thickness; put in the jewel, then wedge it in with the brass pin, cut off neatly, and a very little shellac will hold it in firmly, and then clean off all superfluous shellac from the roller.

Never let a watch that you have repaired be put into its case until you have examined the banking, ticking, &c. With the movement in your left hand, carry the balance around so that the roller jewel is free from the fork, then with the tweezers push the lever back so that the guard pin will rest against the roller, when in turning it loose (supposing, of course, that you have some power in the train, the lever will fall, or be driven rather, back against the banking pin; then turn the balance so as to try the other side. If the guard pin is bent too far back, and the scape-wheel, pallets, &c., are all good and perfect, you will find that the guard pin will remain against the roller, in trying it this way, from the fact that the tooth of the scape-wheel will pass over from the locking face of the pallet jewel to the impulse face of the same, in which event you must bend the guard pin a little towards the roller. If the banking pins are too far apart, the roller jewel will strike against the prong of the fork on entering; if too close together, it will strike against the side of the notch in passing out.

(*To be continued.*)

PRICES CURRENT FOR GOLD AND SILVER.—VALUE GIVEN FOR OLD GOLD AND SILVER BY ASSAY.—Fine Gold, 84s. per oz. Fine Silver, 4s. 10d. per oz.

PRICES CHARGED FOR GOLD AND SILVER.—Fine Gold, 85s. 3d. per oz. Fine Silver, 5s. per oz. Standard Silver, 4s. 6½d. to 4s. 9d. (variable according to quantity).

THE MANUFACTURE OF DIAMONDS.

An important communication was made on Wednesday night to the members of the Glasgow Philosophical Society by Mr. James Mactear, of the St. Rollox Chemical Works. Mr. Mactear said that on the 12th of the month he sent a note to Mr. Dixon (the secretary) giving certain ascertained results. These were of such a startling nature that he stipulated the note was to be kept sealed until that meeting—until, in fact, he had satisfied himself by all the means in his power, and by more competent opinion perhaps than his own, as to the nature of these results. He had submitted the results to Professor Tyndall and Professor Smyth, and they were now in the hands of Mr. Maskelyne of the British Museum. They were briefly these. After a series of careful experiments, extending over a period dating as far back as 1866, he had succeeded in obtaining crystallised forms of carbon. They were perfectly pure and transparent, and had all the refractive power of diamonds. They had the crystallised form of diamonds, and resisted acids, alkalis, and the intense heat of the blow-pipe. They also scratched glass; and the only other test that remained to be applied were as to whether they could scratch diamonds or be scratched by diamonds as to the refractive index of the crystals, and also the measurement of the angle of the crystals. These tests had not, as he had said, been carried out, but they would be shortly, and he hoped to put some of the specimens before the society on a future occasion. He had no doubt in his own mind, and neither was there any doubt in the minds of the scientific gentlemen whom he had consulted, that they were diamonds, but in the meantime he preferred to describe them as pure crystalline forms of carbon. The forms he had obtained were in size one thirty-second of an inch.—*Pawnbrokers' Gazette.*

Since the above was written, Mr. Maskelyne has had these alleged Glasgow diamonds under examination, and the results of his investigation are reported in the *Daily Telegraph* as follows:—

"Glasgow is not yet at least going to ruin the diamond miners at the Cape, as we were led to believe the other day, when a statement was made to the effect that a chemist in that city had discovered how to produce the most precious of gems artificially. Mr. Maskelyne, of the British Museum, has examined the Glasgow diamonds—or rather the almost imperceptible grains of dust sent to him as specimens of home-made diamonds—and he is not quite sure what they are, though he is sure they are not diamonds. As is well known, the diamond exceeds all other substances in hardness, but the Glasgow gem is not hard enough even to scratch topaz. Then they did not behave under polarised light as diamonds do. Lastly, diamonds, being pure carbon, will burn away when heated; but 'the little particles from Glasgow,' says Mr. Maskelyne, obstinately refuse to be burnt, even in the intense heat of a blowpipe. They are probably a 'crystallised silicate, possibly one resembling an agnite.' So for a time the diamond dealers may again breathe freely, and defy the Glasgow chemist who has done his best to frighten them out of their wits. The conditions for cooling vaporised carbon, and getting it deposited in crystalline form as diamond, involve a combination of enormously high temperature and severe pressure not likely to be attained except in the bowels of the earth."

PARISIAN NOVELTIES.—A bracelet slipper has been introduced in Paris. The shoe is cut very low in front, and high up on the instep; it is fastened with a finely chiselled real gold bracelet instead of the usual strap. Another expensive novelty in the same line is the Andalusian boot, made of black satin, with lace ruffles down the front seam, and fastened with real jewel buttons.

TECHNICAL EDUCATION.

APPRENTICESHIP: SCIENTIFIC AND UNSCIENTIFIC.

By Silvanus Phillips Thompson, D.Sc., B.A.,
Professor of Experimental Physics in University College, Bristol.

A Paper Read Before the Society of Arts.

APPRENTICESHIP is the process by which a boy or an inexperienced man apprehends or learns to practice any craft, art, trade, or profession.

Inasmuch, also, as the process of thus acquiring a craft or art was in time past, and in some cases is still, made the subject of a legal contract whereby the master binds himself to instruct the apprentice, and the apprentice to serve his master faithfully, the term apprenticeship is sometimes applied to the legal contract entered into to insure the instruction of the apprentice. The term is also sometimes loosely applied to the period of time during which such process of learning is continued.

Since, then, apprenticeship is a process of learning something, it is clearly, like every other process of learning, subject to definite principles or general laws. Just as there is a right way and a wrong way of learning to read, or to cipher, or to write, so there is a right way and a wrong way of learning a trade or an art, a handicraft or a profession.

Unfortunately, although in each case this observation may at first sight appear to be a truism, it is strange how far the majority of mankind are from believing that there is a genuine science of education, the general principles of which are equally applicable not only to the processes of learning how to read, to cipher, and to write, but also to those of learning how to build houses, to print books, to construct machinery, to compound drugs, or to mould porcelain or glass.

A system of apprenticeship founded upon an intelligent apprehension of these general principles would clearly be defined as a scientific apprenticeship, whilst an apprenticeship in which all such rational general principles were ignored or violated must be as distinctly pronounced an unscientific apprenticeship.

In order that we may realise the vast difference which exists between a scientific and unscientific apprenticeship, let us take an example of a definite nature. I therefore select, from amongst the various trades, crafts, and professions, that one in which the idea of a scientific apprenticeship is, in my opinion, most nearly fulfilled, and which happens to be the profession of medicine and surgery.

Suppose we had the duty of training a youth for the medical profession, what kind of training should we give him to prepare him for his career? I presume we all know that no man can practice in this country as surgeon or physician without a diploma or license, and that such a diploma or license is only granted to those who have been for several years pursuing a course of studies in the theory and practice of their future profession, and have attained to a certain degree of proficiency, as attested by the certificates they produce from one or other of the various recognised medical schools.

Suppose, however, that leaving the accepted routine of lecture-going, reading, dissecting, and hospital practice, prescribed in the schools of medicine for our young aspirant, we were to adopt the following course:—Keep the youth for five years studying metaphysic and dialectic; then, at the end of this period, send him straight to work amputating and drugging, under the directions of an overlooker, whose best qualification was that he could drive the young student through the greatest amount of paying work in the shortest possible time. Suppose, moreover, all theoretical instruction, all access to books, to be carefully eliminated, and that meantime he should be taught to laugh at and despise the notion that theoretical knowledge was of any service to him, even dissection, for the sake of adding to his knowledge and experience, being forbidden him as not being paying work. Suppose this to go on for seven long years, the only change in the routine being that towards the close of his time that he should no longer be required to perform such menial offices as washing floors or running errands. Suppose, I say, this course to be adopted and deliberately defended as a system of medical education, what would be thought of it?

Yet, strange as it may seem, the outrageous course which we have allowed ourselves to suppose is a faithful analogue of that which in thousands and hundreds of thousands of cases is going on to-day, not in the apprenticeship to the medical profession, but in the apprenticeship to the handicraft trades. For the five years of metaphysics, read, five years of purely literary study in the elementary school; and for seven years of unintelligent and uninstructed work, read seven years of unintelligent and uninstructed drudgery in a workshop under an uneducated, unsystematic overlooker, selected for that post simply because he is a good slave-driver; and you have a not overdrawn picture of that which goes by the name of "apprenticeship" in too many of the handicrafts of England.

For, in brief, this is what we do when we have a boy whom we propose to bring up as a carpenter. Firstly, we keep him at the elementary school until he can pass the Fourth Standard, or until he is 13 or 14 years of age. All these years, from the age of eight onwards, he has done nothing but sit at a desk, pen in hand, so to speak, working at studies of an almost purely literary order, and which are only in the most remote manner adapted to the conditions of life he will be called to fulfil. We keep him at school so long that he has almost or altogether lost the taste for work, and would rather starve on a pittance as a clerk than don the workman's clothes to win a day's wage with an honest day's work. Of the uses of tools he knows nothing, possibly not even their names, and of the common things of nature he is profoundly ignorant.

The creature thus prepared in the Board school is, however, to be made a carpenter, and forthwith he is suddenly transferred to a big workshop, where he is greeted on all sides with sights and sounds wholly new and strange, where a language completely different from that of his school teachers is in vogue, where he begins at once to forget all that he had previously learned, and where he must abruptly conform to a new order of things.

(*To be continued.*)

Mr. John Hunt, head of the firm of Hunt and Roskell, who died at the end of November, was for many years a member of the Society of Arts, and of other learned and scientific societies. He was born in the year 1811. His father was Mr. John Samuel Hunt, partner in the firm of Storr, Mortimer, and Hunt, the head of which, M. Paul Storr, had been originally manufacturing partner in the house of Rundell and Bridge. Mr. Hunt earnestly endeavoured, during a long business career, to raise the artistic standard in the silversmith's trade. In 1847 he acquired the services of Antoine Vechte, who received medals for his designs at the Paris Exhibition of 1855, and at the London Exhibition of 1862. He was one of the jurors for the latter exhibition, and his firm guaranteed £2,000. He was also a juror at the Paris Exhibition of 1867. Although his failing health prevented Mr. Hunt from taking an active part in the more recent international exhibitions, his firm continued to receive medals for their productions.

THE Watchmaker, Jeweller, & Silversmith,

A MONTHLY TRADE JOURNAL,

Devoted to the interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades; published at Milner's Buildings, Moorgate Street (Opposite Moorgate Street Station), London, E.C. Booksellers and Newsagents supplied by Messrs. Catty & Co., 12, Ave Maria Lane, Paternoster Row, E.C.

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MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Bourne, John, Newhall Hill and Rann Street, Ladywood, both Birmingham, electro-plate manufacturer. Nov. 28. Tyndall, Tyndall and Deakin, sols., Birmingham.

Chappell, Thomas, Dalyell Road, Stockwell, late Great Marlborough Street, jeweller. Nov. 25. G. B. B. Norman, sol., 22, Great Marlborough Street, Regent Street.

Gardiner, George, 34, Aldgate, and St. Paul's Road, Camden Town, optician. Dec. 5. E. Lee, sol., 1, Gresham Buildings, Basinghall Street.

George, Richard Edward, Bishop's Castle, Salop, watch and clockmaker. Dec. 2. E. Griffiths, sol., Bishop's Castle.

Ellicock, Joseph, Bourn, Lincolnshire, silversmith and watchmaker. Dec. 8. Deacon and Wilkin, sols., Peterborough.

Olive, Michael, Arwenack Street. Falmouth, watchmaker and nautical instrument maker. Dec. 17. W. Jenkins, sol., Falmouth.

Beaumont, Charles Richard, Cooper Street, Withington, watchmaker. Dec. 24. J. Sampson, sol., South King Street, Manchester, Jan. 15, at 3.

Keey, William Henry, Lower Arcade, Bristol, jeweller. Dec. 24. C. H. Lane, sol., Bristol, Jan. 6, at 12.

Adjudications of Bankruptcy.

Caspers, Alfred & Charles Julius Caspers, trading as Caspers and Co., 37, Walbrook, watch and clock importers. Dec. 11. At Bankruptcy Court, Lincoln's Inn Fields, Jan. 16 at 12. Murray, Reg.

Faller, Christine & Henry Hollanders, Commercial Road, Landport, refreshment-house keepers and watchmakers. Dec. 12. At C.C., Portsmouth, Jan. 8 at 12. Renny, Reg.

Silberman, Gabriel, 30, Gordon Road, Stoke Newington, dealer in jewellery. Dec. 23. At C.C. Edmonton, Jan. 13 at 1. Pulley, Reg.

Meetings.

Finding, Samuel, (Bkt.), Bedford, jeweller. At C.C. Bedford, Jan. 8 and 12, exam.

Dividends.

Foad, Andrew B., (Bkt.), Norwich, watchmaker. Div. 1s.; J. G. Atkinson, sol., Norwich.

Bamber, John W. (Bkt.), Preston, jeweller. 1st and final div. 11½d.; T. Thorp, Lune Street, Preston.

Jones, John (Liq.), St. Peter's Street, Mile End, dealer in watch materials. 1st and final div. 9d.; E. A. Jones, 93, Hatton Garden.

Trustees Appointed.

Dold, Anton (Bkt.), Great Grimsby, jeweller. Tr., S. Barnett, Hockley Hill, Birmingham, jeweller.

Musker, George, trading as Musker & Co. (Liq.), South Castle Street, Liverpool, and Tue Brook, near Liverpool, watchmaker. Tr., H. Bolland, South John Street, Liverpool.

Read, William, trading as Henry Simpson & Co. (Bkt.), Bishop Street, Coventry, watch manufacturer, &c. Tr., E. T. Peirson, Coventry, Accountant.

Foad, Andrew Baker (Bkt.), Norwich, watchmaker. Tr., G. Kersey, Norwich, accountant.

Toleman, John (Liq.), Pwllheli, Carnarvonshire, watchmaker. Trs., R. Williams, Pwllheli, auctioneer, & J. Liveridge, Great Charles Street, Birmingham, jeweller.

Royle, Samuel, & Peter F. Rawson (Liq.), Wigan, jewellers. Tr., G. Ormandy, St. Helen's, accountant.

PATENTS.

United States of America.

221,178. William A. L. Miller, of San Francisco, California, for "Ear-rings."—Application filed 9th April, 1879.

221,210. Dudley W. Bradley, of Brooklyn, assignor to the Seth Thomas Clock Company, of New York, N.Y., for "Striking-clocks."—Application filed 22nd March, 1879.

221,213. Hiram Camp, of Newhaven, Conn., assignor to the New Haven Clock Company, of the same place, for "Clock-pendulums."—Application filed 2nd October, 1879.

221,310. Arthur E. Hotchkiss, of Cheshire, Conn., for "Clock-movements."—Application filed 29th July, 1879.

221,606. Aloys Platt, of New York, N.Y., for "Watch-regulators."—Application filed 30th September, 1879.

221,666. Silas H. Cate, of Watertown, Mass., for "Winding attachments for watches."—Application filed 28th May, 1879.

221,926. Adolph W. Magerhaus, of New York, N.Y., for "Bracelets."—Application filed 21st March, 1879.

France.

130,448. Dupin, for "A remontoir watch."—Dated 7th May, 1879.—Class 12.

130,622. Walzer, for "A construction of watches."—Dated 12th May, 1879.—Class 12.

130,691. Guilmet, for "Continuous escapements for clock-work."—Dated 16th May, 1879.—Class 12.

130,692. Lion, for "Manufacturing bracelets, necklaces, and other jewellery."—Dated 16th May, 1879.—Class 17.

130,877. Diette, for "A clock-motion with three sets of wheels and repeaters at will."—Dated 26th May, 1879.—Class 12.

130,956. Blanchetti, of Paris, for "A clock-motion."—Dated 30th May, 1879.—Class 12.

131,030. Japy, Brothers, and Co., for "A machine for setting precious stones in watches and clocks."—Dated 4th June, 1879.—Class 12.

131,098. Cros and Denorus, for "A universal romontoir-key."—Dated 3rd June, 1879.—Class 12.

131,293. Baluze, of Paris, for "Circular escapements, independent balanciers, &c., for clockwork."—Dated 19th June, 1879.—Class 12.

131,336. L'Epee, of Sainte-Suzaune, for "A double-wheel escapement for clockwork."—Dated 23rd June, 1879.—Class 12.

131,362. Pochiet, for "Manufacturing jewellery articles."—Dated 21st June, 1879.—Class 17.

131,411. Bourquin, for "Synchronic dials and hands of watches and clocks."—Dated 25th June, 1879.—Class 12.

131,511. Aubert & Son, for "A mechanism for prolonging the action of musical boxes."—Dated 30th June, 1879.—Class 17.

131,518. Gradoz, of Lyons, for "Spiral hooks for ear-rings."—Dated 21st June, 1879.—Class 17.

Kingdom of Italy.

12. J. L. Falize, of Paris, for "Engraved and enamelled decorations for gold articles and jewellery."—Dated 28th March, 1879.

132. E. Berthond, of Cortaillod, Switzerland, for "A construction of remontoirs for watches."—Dated 26th April, 1879.

133. J. Walzer, of Recouvillier, Switzerland, for "A construction of watches."—Dated 15th May, 1879.

Applications for Letters Patent.

5020. **EBENEZER DOBELL**, of 21, Robertson Street, Hastings, in the county of Sussex, Jeweller, for an invention of "An improvement in 'solitaires.'"—Dated 8th December, 1879.

5029. **CHARLES LOUIS BAUD** and **CÉSAR HENRI LECOULTRE**, of the firm of Baud and Lecoultre, of Sentier, in the republic of Switzerland, for an invention of "An improvement in the construction of watches."—Dated 9th December, 1879.

5100. **THOMAS HEATH**, of Birmingham, in the county of Warwick, Jewel-Case Manufacturer, for an invention of "Certain improvements in cases for holding jewels, gold, silver, or electro-plate ware."—Dated 13th December, 1879.

Grants of Provisional Protection for Six Months.

5020. To **EBENEZER DOBELL**, of 21, Robertson Street, Hastings, in the county of Sussex, Jeweller, for the invention of "An improvement in 'solitaires.'"

Notices to Proceed.

4426. **WALTER HIRST**, **WILLIAM HIRST**, and **JOSEPH HIRST**, all of Sheffield, in the county of York, have given notice in respect of the invention of "Improvements in centre-second stop watches."

Patents Sealed.

2490. **JACOB MERZBACH**, of Holborn Viaduct, in the city of London, for an invention of "An improved clock movement." A communication to him from abroad by Oreste Blanchetti, of Paris, France.—Dated 21st June, 1879.

4451. **WILLIAM ROBERT LAKE**, of the firm of Haseltine, Lake, and Co., Patent Agents, Southampton Buildings, London, for an invention of "Improvements in and relating to clocks and other time-keepers,"—a communication to him from abroad by Arthur Ethelbert Hotchkiss, of Cheshire, Connecticut, United States of America, Mechanic.—Dated 31st October, 1879.

GREENWICH CHRONOMETER TRIALS, 1879.

THE results of the present year's chronometer trials at Greenwich are very satisfactory, and prove beyond all doubt that these annual competitions are a powerful stimulant to chronometer makers. There were 30 chronometers entered altogether; and the ratings commenced January the 11th and ended July 26th, so that the duration of the trials was 28 weeks. During four weeks from the 1st of March, and during four weeks from the 17th of May, the chronometers were placed in the chamber of a stove heated by jets of gas. The flames are exterior to the chamber, into which none of the injurious products of combustion can enter. All the chronometers were two-day, and the lowest temperature in which they were tried was 35 deg. Fah.; the highest, 108 deg. Fah. The following five chronometers rank first:—No. 282, by Keys, 15, Craven Street, Strand, W.C.; ordinary balance with slight alteration. No. 6144, by Isaac, 10, Spencer Street, Clerkenwell, E.C.; with improved balance. No. 2028, by Edward and Sons, 92, Buchanan Street, Glasgow; with improved ordinary balance. No. 7052, by Russell and Son, Church Street, Liverpool; auxiliary to balance. No. 5658, by Cornell, 74, Bank Street, Maidstone. With exception of No. 2028 the balance of these chronometers had Airy's compensation adjustment.

The differences between the greatest and least weekly sum were 6·0, 10·3, 13·6, 13·4, and 14·9 seconds respectively, and the greatest differences between one week and the next 2·9, 6·7, 6·1, 6·8, and 6·3 seconds respectively.

WATCHMAKERS AND THE TRUCK ACT.—I hear from various quarters that several of the smaller watch manufacturers have for some time past been paying their men part of their wages in goods instead of in money. This system is a bad one, and unjust to the men, who have hard enough work to live on what they earn even when they receive their wages in cash. Such payments are, moreover, illegal, and I fancy it need only be generally known that under the "Truck Act" any manufacturer making such illegal payments is subject to penalties varying from £5 to £100, according to the nature of the offence, and that a substantial proportion of the penalty goes to the informer, to have the practice put an end to.—*Coventry Herald.*

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EXCELSIOR STEAM WORKS.

ONE of the attractions of Aldersgate Street is certainly the new manufactory of Messrs. Potter and Sons, the widely-known purveyors of jewellery cases, window tickets, jewellers' shopfittings and sundries. We gave in an earlier issue of our journal a detailed description of this extensive and well-appointed establishment, and we are sure that those of our readers who have had the opportunity of paying a personal visit to this establishment since then will admit that a more suitably arranged and better regulated manufactory, in this branch of business, is not to be found anywhere. It may be imagined that an increased producing power and additional facilities for the sale of their products have considerably extended the operations of this firm, not only in quantity but also in variety. "Excelsior" is certainly a very appropriate name for this establishment, since progress is manifested all over the place; they are ever striving to invent fresh conveniences for the trade, and to improve and cheapen existing ones. A host of new articles have been devised for the use of watchmakers, jewellers, and kindred trades, since we last had the pleasure of visiting this hive of industry; and the customer who cannot get what he wants in this line here, may no doubt look for it in vain elsewhere.

We can, however, only enumerate some of the leading articles manufactured and sold. They include:—Window-tickets, comprising the largest and most varied stock. Jewellers' morocco cases for suites, half-suites, brooches, earrings, lockets, locket and necklet, watches, watches and chains, pins, studs, rings, necklets, bracelets, links, solitaires, pencil cases, fruit knives, etc., etc. An immense variety of the above are always kept in stock. Jewellers' velvet stands, trays, etc., are kept in stock in upwards of one hundred varieties, suitable for displaying every description of jewellery. Then they supply brackets and fittings, standard bars, tapped bars, bronzed rods in endless variety, outside lamps, inside reflectors, door and other lamps of best London manufacture, plate glass and other counter cases, various sizes and qualities, glass shelves, watch trays, ring trays, thimble, pin, pencil, oval and all ordinary glass cases. Ticket and other books for every requirement of window dressing; all kinds of jewellers' printing and stationery, such as invoices, memorandum forms, billheads, business cards, lists, club circulars, illustrated lists, catalogues, folding cards, wrapping papers, labels, etc., etc. Various qualities of spectacle cases at lowest prices; then an immense variety of sundries, as—jewellers' nested paper boxes, plain or printed with name, paper ring and thimble boxes, tabs for job watches, parchment tabs; stock, job and watch books, watch warrantys, clock warrantys, white, blue and pink wool, sealing wax, packing papers, tissue, strings, twine, manifold copying books, ledgers, journals, account books, parcels books, receipt books, wrapping paper in packets, etc., etc. We must not forget to mention their Job Envelopes, which have an immense sale, and for general utility are unsurpassed; and their Subscription Cards for watch, clock and jewellery clubs. They have designed an attractive four-page circular containing illustrations of watches, clocks, etc., together with letterpress matter explaining rules.

The numerous contrivances in the shape of hooks, brackets, and other valuable auxiliaries to the window-dressers introduced by this firm are well known and appreciated, and their FACILE HOOK, a late addition, is proving equally useful. Previous to the introduction of this ingenious novelty, no hooks could be obtained for the special purpose of holding rings. The "Facile Hook" is registered and made in two varieties; one of them has a steel spring clip for fastening on glass shelves, while the other has a pointed end for sinking into cases, trays, etc.; they are certainly most practical, and combine, in addition, the desirable qualities of simplicity and cheapness. Messrs. Potter and Sons also sell jewellers' scales and weights of the best make only; the new decimal weights are kept in stock from ·001 to decimal 4 oz. troy.

PRODUCTION OF PRECIOUS METALS IN THE UNITED STATES.—The report of the directors of the United States Mint states that the production of the precious metals in the United States in 1879 was considered less than that of the preceding year. After careful inquiry and consideration of the yield of different localities and mines, the director estimates the total production of the precious metals in the country for the fiscal year 1879 at 79,712,000 dols., of which 38,900,000 dols. were gold, and 40,812,000 dols. silver, as nearly as can be ascertained from official and other trustworthy sources. It is also stated that the annual consumption in the United States of the precious metals in all forms for manufacturing purposes now averages 7,000,000 dols. of gold, and 5,000,000 dols. of silver.

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CONTENTS.

PAGE
Going Barrel *versus* Fusee 97
A New Night Timepiece 100
Practical Instructions to Jewellers, Silversmiths and Electro-platers 101
Book Notices 101
The Silver Trade 102
Permanent International Exhibition in Brussels 102
Hints to Repairers 103
Association of Watch-Manufacturers in Geneva.. 103
Watchmakers', Jewellers', and Silversmiths' Trade Society 104
The Manufacture of Diamonds 106
The French and Swiss Watch Trades .. 107
Monthly Record of Bankruptcies 108
Patents 108
Conch Pearls 110
Directory ii
Advertisements .. .. i-x

No. 57.—Vol. V.] FEBRUARY 5, 1880. [Subscription, 5s. per Annum. Post Free.

GOING BARREL *versus* FUSEE.

THE Council of the British Horological Institute wisely determined some time ago to offer members the facility for holding meetings for the discussion of trade questions. This is certainly a desirable extension of usefulness on the part of the Institute, and if these meetings are well supported and carried on in a fair and energetic mannner much good result may be expected. The first of these discussion meetings was held under the presidency of Mr. Jackson, V.P., the subject being "the wisdom of substituting the going barrel for the fusee in the English watch manufacture." A more important and more opportune subject could not have been chosen. The discussion was opened by Mr. Glasgow, who tried his best to defend the fusee. He loves this "dear old friend;" so do we; and if our existence as a watch-making nation was not imminently hazarded by it, we should be sorry to part with him. Our own views on the matter are well known to our readers; we shall, therefore, confine ourselves to reporting the opinions of others:—

Mr. Glasgow said: It is not necessary for me to say what views of this question I take, as my opinions are pretty well known in the trade, and, although I am not responsible for the discussion of it, I know of no other question of greater importance to watchmakers at this moment; I therefore think that in the quiet of a great depression we should estimate the position in which the change in the fashion of watches has placed us, in order that we may be ready to supply a demand for first-class watches (as hitherto we have been able to do) when a revival of trade comes. The recent desire of the public to obtain, and of the shopkeeper to sell, keyless watches has, as you are aware, induced many watchmakers to adopt the going barrel instead of what we were accustomed, not many years ago, to consider the very essence of the English watch, viz., the fusee, as with its aid we are enabled to obtain an easy and perfect adjustment of the mainspring at its source. As, up to this time, this doctrine has never been (at least publicly) abjured by English watchmakers, it is well that we should ask ourselves now whether we have altered our opinions, and, if so, openly state the fact, or whether we will allow the encroachment of the going barrel to steal upon us insidiously, and, while still professing the superiority of our own models, find that we have drifted into a system that can only be defended on the grounds of present profit and expediency. I think this course unworthy of watchmakers, and I at once declare that I think no greater misfortune could befall the English watch trade than the substitution of the going barrel for the fusee in this manner. I may be laying myself open to a retort (having tried my hand at the improvement of the going barrel, in order to make it more suitable to the requirements of our watches); but had I shown a much greater zeal in this direction than I have done, that would not deprive me of the right to state at all times my preference for the very old friend of English watchmakers, the fusee. There are two questions I will ask you to consider in relation to this subject. The first is of the greatest importance, and, in the minds of some, the only one with which this institute should concern itself, and that is the scientific superiority of an adjustment of the varying and unequal force of the main spring at its source, by means of the fusee, over the many other modes of minimizing the still greater inequalities of a spring wound round an arbor and acting directly on a train. The second is the commercial consideration; and although I think my contention in favour of my views would require fewer words to convince if I eliminated a side issue and and argued between the going barrel simple and the fusee, without making the keyless mechanism a factor in the case, I will not do so, but face the matter fairly. I do not admit that keyless watches will ultimately supersede all others; an æsthetic taste pervades a portion of the community now that makes them object to the appearance of them, and as to the convenience, there is no watchmaker who would not rather wind three watches of ordinary construction than one keyless watch! The fashion has changed before, and will again, I have seen (as many of you have seen) going barrel keyless watches made by a great man, Arnold, nearly a century ago, but his successor, Charles Frodsham, as great a man as he, did not think it necessary to follow his predecessor's example, but contributed largely to the fame of English watchmakers, not by pandering to a passing whim of the public, but by constructing a large number of fusee watches that will long remain witnesses to the excellence of the English watch and to the thoroughness of the English workman. I will now consider the action of the main spring; and there is certainly no other condition in which a steel spring is called upon to exert its force in so unscientific a manner as in the barrel of a clock or watch. In a well-made fusee watch there are no more than three turns of the barrel required to make the watch go thirty-two hours, and it is only necessary to set the spring up about a fourth of a turn. Taking then the rough and ready measurement of dividing the barrel space into three, one part spring, one part space, and one part arbor, with only a fourth of a turn of spring on the arbor, you have it exerting its force from the time you begin to wind until three turns are wound round the arbor, perfectly free from the friction of the coils rubbing and hugging each other; the square hook in the spring, keeping the outer end firmly fixed in its place, prevents the coil friction I have referred to, and permits the spring to exert its force, towards or from the centre, by the action of that portion of it which is free for the moment, and not (as in a going barrel) where the spring is nearly all wound round the arbor, and moves outwards in jerks. The old Swiss understood this, and rarely applied the new panacea of a long spring, and a turn and a half set up; to obtain a rigid fixing of the spring, they put what is called a post (which, as a rule, you will find only by the oblong holes in the barrel and cover, the post having been thrown away); that is a piece of spring placed horizontally between the outer end of the main spring and the coil next to it, about half an inch from the end of spring, and inserted into the bottom and the cover of barrel; and by this roundabout and clumsy method obtained the same result (with the loss of considerable barrel space) that we do by a square hook in the spring, and a corresponding hole in the barrel. There is some excuse for the Swiss retaining their method of making a hole in the spring and a pin in the barrel, as their barrels are very shallow as a rule, and as the proper strength of a spring to a going-barrel lever is very uncertain. After a trial you may have to change the spring. But what can be said for English watchmakers who follow this bad example, and put a brass pin in the side of the barrel, projecting more than the thickness of the spring through the hole, in order to keep it from pulling off, the strong spring usually pulling the brass pin with it when taken out; but so abiding is the ignorance and bad habits of men brought up in this school, that if a main spring is to be replaced by them they will disregard all excellence of work, and screw a brass pin into the side of a barrel of the best English watch, file off the gilding and leave the square hole as a witness of their unfitness to touch such work; this mode of hooking in a spring permits it to fall to or from the centre in a jerky and unsteady manner, two or more coils moving in or out at a time; this, and the direct action of the main spring on the train, causes a constant variation of force, so great, that if you observe the balance of a good going barrel lever watch for some hours, you will find it has a constant and visible variation of arc; and if this watch, when clean and in good order, does not vibrate sufficiently far, when wound up, to cause it to bank by the least external motion, it will be liable on the least thickening of the oil to stop altogether, that is, if the escapement is a really good one. Then the breaking of a main spring has introduced a new danger, against which the ever ingenious Yankee has provided a remedy (patent, of course), that is, the breaking of the leaves of the centre pinion. But why continue objections of this sort? The barrel is cheaper, and the world wants cheap watches, we are told. Now what is the difference in price of a first rate fusee and a going barrel watch? Only in the movement and finisher's work. I will not quote figures. You know that a very small sum indeed would represent it in a Lancashire movement, and the difference in a finisher's work is not the tithe of the price of even the commonest movement. There is also more than one good and reliable fusee keyless mechanism in use, costing very little more than the mechanism adopted in going barrel watches. But all these facts are ignored by those speculative philosophers who base their arguments on what might be, if we only gave up our foolish desire for excellence and worked for the million. From various causes (the principal being the great facility they have of making the cylinder escapement) the Swiss have the markets of the world for small cheap watches practically in their hands. I see no mode of competing with them successfully but by adopting their methods and their models, and, if even this were possible, I would ask, Is it desirable? But the grand argument is, you should do both; keep your fusee, and rival the Swiss and Americans in cheapness and badness. I say this cannot be done; it has never yet been done. We must do one or the other. Every watchmaker knows the difficulty of going out of his own particular manufacture. The two systems cannot be carried on side by side; we must have an object in view and a standard to reach. Is that standard to be excellence or cheapness?

[This is simply ridiculous, excellence is quite compatible with work for the million. Cheapness and badness are not always combined. Mr. Glasgow has evidently that class of goods in his mind which the Swiss term *camelotte* or *pacotille*, and at which the respectable manufacturers of that country are as much disgusted as we are. A Watch Manufacturers Association lately founded at Geneva has for its immediate object the extermination of these sham timekeepers. We must certainly never lower ourselves to make goods at prices which do not allow *good work*; we must not try to *undersell*, but to produce something superior at the same price. That is wholesome and honest competition. There are always men in every country, and in every branch of industry, ready to manufacture anything for the sake of profit, but we do not think that it is a greater sin to make and sell a bad fusee watch at a comparatively high price, than it is to make and sell a bad going barrel watch at a much lower one. Everybody knows that both France and Switzerland produce not only cheap watches, but also high class ones, watches which would be a credit to any nation; the chronometers of a Leroy or a

Grandjean, if not quite up to our own standard of perfection, are not to be despised; besides, improvement is continual with them, and that in countries where going barrels are manufactured for the million. It is certain that neither the French nor the Swiss will encourage us to get out of our old ruts, they are quite aware what such change in our system of manufacture means.

Mons. Adrien Philippe, one of the most honoured names in connection with the Swiss watch industry, candidly says in his articles on the horological exhibits at the Paris International: "We can only suppose that English watchmakers believe they have reached perfection, or that they are so far on the way towards it that they can afford to despise the efforts of their rivals to overtake them. Be it so; *Messieurs les Anglais;* sleep on in this happy tranquillity of spirit; you have a sufficiency of other industries in which your engineers, your inventors, and your intelligent workmen may find ample scope for their activity; you may well afford to leave one field open to competitors less favourably situated. Switzerland will not complain, neither probably will America, that England makes so slight exertion to preserve the markets where her ancient reputation might still, perhaps, give her the preference if she would only take the trouble to keep her productions on a parity with those of other countries." Ed.]

The Americans for good reasons, have adopted the latter, and private interests in England are constantly tending towards it; but is abstract science benefited? Will the wearers of watches or the makers of watches be benefited by our adopting it? I think the majority of members of this Institute should not adopt this standard, but that we should tread the path of men of great thought and great industry who have gone before us, and keep to a machine that will fully develop one of the greatest products of mechanical skill, the escapement of Thomas Mudge. If our standard be not excellence, then I see no possible use in all this talk of technical education; indeed, I see no use in the Horological Institute or its teaching. But this going barrel is a material element in a question that is now presenting itself to many minds, and that is the factory system in watchmaking. I must acknowledge to a perfect hatred of it where it can be avoided; it is the trampling out of every aspiration and the degradation of the many for the sake of the few. It is an oligarchy of trade seeking in the nineteenth century to fill the place of the feudal autocrat of the Middle Ages, and ends in nothing but stolid communism. Where individual exertions are discouraged, combination is the natural result, and we have strikes and bad feeling where there should be harmony and unity of interests. If we set up for ourselves the standard we have hitherto aimed at, we need not fear the factory system; there is enough in our trade to develop and keep in activity all our better faculties; we have still much to do, and I hope these discussions may be an incentive to intellectual culture, and a still further diffusion of the highest principle of our trade, amongst watchmakers.

Mr. Whittaker said: Although I differ from Mr. Glasgow on the subject before us, I cordially agree with him and with our chairman that there is no other question of greater importance to watchmakers at this moment, and I trust it will receive the attention it deserves. Concerning great questions it has been well observed by Mr. Watherston (in a speech made at the Society of Arts on Professor Thompson's lecture on Technical Education) that all great questions have to pass through three stages—firstly the "pooh-pooh" stage; secondly, the bow-bow stage; and thirdly, the "Didn't I always say so" stage. Twenty years ago, when this Institute was first established the going barrel was then, as it is now, the great question, and if you will refer to the record of a very influential meeting, which I well recollect to have attended in Nov. 1859, you will find that we were in the first stage, pooh-poohing the going barrel, and since that meeting we have paid a heavy penalty for our pooh-poohing in the loss of an immense trade. While Mr. Glasgow is a great advocate of the fusee, it cannot be said that he has pooh-poohed the going barrel to-night; I think he has arrived at the bow-bow stage, for he says of the going barrel that it will go as well as any fusee watch of its class, and that the main-spring will adjust. I admit the first but deny the second statement. Let us hope that we shall get into the third stage a little quicker than we have been in getting into the second. In order to rightly estimate the relative value of the going barrel it would be necessary to enquire carefully and without prejudice into its construction, a question I cannot do justice to to-night. But the whole matter may be briefly summarised thus: For chronometers and for certain high-class lever watches, where the utmost attainable exactness is of absolute necessity, no one can dispute the superior excellence of the fusee; but for certain high-class watches key and keyless, where the utmost strength and durability, combined with flatness and cheapness, and where perfect precision is not demanded, the going barrel is superior to the fusee, and for such work it is wise to adopt it. Americans and Swiss err in boasting the highest results from the going barrel; we err in the opposite direction by using the fusee in best flat work, and in second and third class work; and thus, by increasing the cost of production, we make successful competition impossible. To say that a going barrel cannot be made for less money than a going fusee shows great weakness or great wickedness on the part of those who make such statements. We make the fusee-work for the world, why not make the going barrel also? I hope the time will come when we shall do as large a trade in going barrels as we are at present doing in beer barrels. But the point they were met to discuss was the wisdom of substituting the going barrel in the English watch manufacture; and this brought them face to face with the fact, that while we were adhering to our old method of manufacture, the Swiss and the Americans were gradually and surely taking the bulk of our trade. The statistics published in their own Journal showed the imports of foreign watches to have increased to almost fabulous figures, while the home manufacture was languishing. Watchmakers could not dictate to the public as to whether they should have a keyless watch or not. The public had practically decided that the keyless watch was the desirable one, and there could be no question that the going barrel was best for a keyless watch. If properly constructed, it gave good results. Then, while he admitted the good points of the fusee watch, when properly made, it was indisputable that in the ordinary run of medium work it was the cause of constant failure. It might be a small matter if, for instance the chain broke here, in Clerkenwell, but he could say from experience that in America the constant recurrence of such trivial matters really rendered the watch worthless, besides being a source of annoyance to the owner and the unfortunate watchmaker to whose wretched lot the repairs fell. It was, indeed, this constant failure of the fusee watch which had lost us the American market. He could not agree with Mr. Glasgow as to the superior status and position of the workmen under the old system of manufacture. A visit he (the speaker) had recently paid to Prescott showed him that the prosperous men were the going barrel makers, while the fusee makers were in a pitiable state.

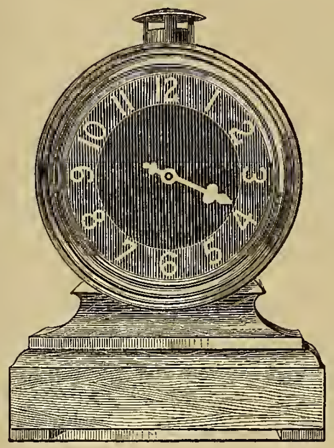
Mr. C. Dunn said no doubt the American market had suffered from dishonest manufacturers sending bad watches there, but it must not be supposed that all English watches sent there were bad. Twenty years ago, many respectable firms fully sustained their names in the watches manufactured for America. The excessive import duty also had done a good deal in destroying our American Trade.

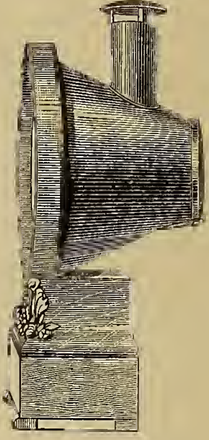
Mr. Ganney said, in his opinion the going barrel was best suited for at least 90 per cent. of English watches. But it was not only in the going barrel or fusee question that the future of the English trade was centred. The whole system of manufacture wanted revision. The Americans had showed us what could be done with machinery, not only in watch-work, but in other mechanism. He quite endorsed Mr. Whittaker's remarks as to the difficulty experienced in repairing English watches in America, on account of their bad construction.

Mr. Bickley said that the evil repute into which the fusee had fallen was, in great measure, owing to the foolish fashion which prevailed some years ago of making very flat watches. When Swiss watches first came into use in this country, the public taste ran on a thin watch, and English makers, alarmed at the success of their foreign rivals, instead of trying to guide the public mind, endeavoured to meet the fashion of the day, by making very flat fusee watches. The result was a wretched failure, as any one might have foreseen. Every watchmaker knew, or ought to know, that it was impossible to make a very flat fusee watch to give satisfaction. At the time of which he spoke, it was usual to make 16 and 18-size watches 4 and 5 below 0. Large, heavy, showy balances were put to them, requiring strong main springs to produce any vibration, while the chains were no thicker than one would expect to see in a 6-size watch. It was well known that large quantities of such watches had been sent to America and other places abroad, and how could we wonder at the English fusee watch having got a bad name when it was represented by such things as he had tried to describe,—mere abominations, utterly unworthy to be called watches. At the same time, it was folly to condemn a principle because it had been abused and spoiled. His experience was, that fusee watches very seldom failed when properly made. As a starting-point, the frame must not be too low. To ensure a good chain, the fusee must be as thick as the frame will admit, and then, with a moderate balance and a properly-fitted main spring, there would be but little risk of failure. Finishers very often caused the chain to be thinner than it need be by turning the fusee at the back in an unnecessary manner. It was not at all uncommon, even in the watches of which he had just now spoken, to see a great wheel with three times more freedom than was necessary; for finishers did not seem to understand that a great wheel required but very little more freedom than any other wheel, if the fusee was properly planted in the frame. He thought it would be most unwise to abandon the fusee in lever watches. It possessed within itself the elements of adjustment, which the going barrel did not. He would not say it was impossible to make a going barrel watch give good results, but, at best, it could only be done at the seat of manufacture, for so soon as an improper main spring was put into it the good results would be gone. The lever escapement was not adapted to the going barrel. Indeed, the more perfect the escapement the more sensitive it became to the varying force. He not long since met with an ordinary lever watch, which, from the uncertain force of an improper main spring, varied as much as four minutes in twenty-four hours.

A NEW NIGHT TIMEPIECE.

TO the invalid, the nurse, or the sleepless, a night clock, or one which shews the time at night by means of an illuminated dial, is a great convenience; but although many ingenious methods have been devised, no timepiece has yet been invented fer this purpose without some counter-balancing disadvantage. The earliest style was a ground-glass dial, with a night-light burning behind it; the hands were worked by a small watch-movement, taking up a space in the centre of the dial, and were invariably too heavy for the works, and constantly dropping down by their own weight. Then we had the pillar night-clocks, with an opal globe revolving on a pedestal, a light burning inside, and a stationary hand pointing to the hour, the figures being painted on the outside of the globe. But these globes gave out such an intense light, that the room was rendered uncomfortably bright for a light sleeper, and if by any chance the globe was moved the correct time was lost. Then, later still, we had clocks with phosphorescent dials, but these were illegible at four feet distance, and invisible at eight feet; besides, the dials in time lost their phosphorescent power, and became useless for their purpose. In the timepiece of which we subjoin a sketch these objections are happily overcome.





The face of the clock consists of a glass fixed dial, opaque excepting the figures. In front of this dial is placed another similar one, opaque excepting a hand or arrow. This outer dial has a toothed rim, hidden by the frame, and is pivoted to the centre of the fixed dial: it revolves by means of a balance movement hidden in the body of the clock, and goes for eight days.

At the back of the dials, and fixed to the frame by two slots, is a truncated cone reflector of burnished metal, containing a small night-light, or benzoline lamp, which is raised by a tripod stand to the centre of the dials. This light is thrown full on the dials by the cone, which intensifies the small flame wonderfully. Not a particle of light escapes to annoy the sleeper, as the chimney is capped, and the dials being of ground glass the light is not diffused, and does not reflect in the slightest degree. In fact, on turning your back on it in a dark room, you would only be aware of its presence by a soft steady tick, hardly audible. And yet the time can be distinctly told at a distance of more than 40 feet, owing to the bold character of the figures. The light will burn for about 12 hours. To trim the lamp the back of the cone is removed.

The same principle is also applicable for the illumination of ships' compasses at night. For this purpose the light is placed by the side of the compass, and an opening made in the case, to admit the light to a reflector fixed under an angle of 45 degrees beneath the horizontal dial. The construction of the movable dial for the compass is the same as for night-clocks. The inventor of this ingenious novelty is Mr. Charles Desprez, of 30, Park Street, Bristol.

WATCH TRADE IN SWITZERLAND.—Reports from the watch-making centres of Switzerland show marked improvement. Heavy orders for the United States are said to be in hand. A letter received a few days ago informs us, however, that there are still a number of workmen unemployed and depending upon public relief, especially in Chaux-de-fonds.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. X.

(*Continued from page* 85.)

Grove's Battery.—This battery is like the preceding one, except that it has a platinum foil which plunges into the nitric acid, and replaces the prism of carbon. This foil is supported by a small brass stand, fixed itself to a round band resting upon a rim on top of the exterior vase. A binding screw is soldered to the stand to receive the end of the copper ribbon of the preceding zinc. The several elements of batteries are united together in the manner already described, the zinc to the platinum of the next element, and so on. The only disadvantage of this battery is its great cost, due to the platinum employed. Mons. Hulot has proposed to substitute aluminium for the platinum. The battery remains however still an expensive one, which prevents its more frequent industrial application.

Grenet's Battery.—A solution of 100 parts of water, 10 of bichromate of potash, and 10 of sulphuric acid in the porous cell, replaces the nitric acid employed by Grove and Bunsen. This battery does not emit acid fumes,an advantage which does not compensate the rapid incrustation of the carbon with oxide of chromium, resulting in the stoppage of the galvanic current.

Marié-Davy Battery.—Slightly damped sulphate of mercury replaces the nitric acid in the porous cell. The working expenses of this battery are very high, and it is used only in the Telegraphic Service, and even there it has been superseded by the Daniell battery with balloons, or by the Léclanché, of which we shall speak presently.

Smee's Battery.—This battery is very simple in construction; acts by means of a single liquid, obtainable anywhere, and emitting neither odour nor acid fumes. This battery should be employed by all jewellers and silversmiths who are obliged to do their gilding and silvering in the shop itself. It consists of a thick wooden frame open at the top, with three internal parallel grooves which run the height of the two opposite sides. The middle groove receives a movable plate of silver, platinum, gold, or copper which has been strongly gilt, silvered, or platinised; its surfaces must be rough or with a dead lustre. Two plates of strongly amalgamated zinc are run down the other two grooves. The zinc plates must be near to, but not in contact with, the central one, and are connected by a wire or metallic band. The positive wire starts from the middle plate, and the negative from any point of the zinc, and the whole apparatus is immersed in a solution containing common salt or one-tenth of sulphuric acid.

Several elements may be united together by connecting the zinc of the first with the middle plate of the second. I have modified this battery by making the cell of gutta-percha, with a plate of carbon to replace the plate of silver, or of platinized copper. The two other grooves receive two plates of amalgamated zinc, with one of the upper corners cut away. A double binding screw, for the positive wire, is fixed upon the plate of carbon where the two zinc corners have been cut off, and another large binding screw unites the two zinc plates, and carries the negative wire. To bring the battery into action, fill the cell with water saturated with common salt, or acidulated with one-tenth of sulphuric acid. Several elements can, of course, be connected in the same manner as in the usual form of the Smee battery.

If an acid solution is used, amalgamating salt may be added to keep the zincs in good condition, and to prevent the disengaging of hydrogen gas; but for a salt solution the amalgamating is superfluous.

Léclanché Battery.—This is a battery combining economy and safety, with constancy and durability. Like the Daniell cell, it acts without acids, produces no vapours or exhalations, and can be kept in operation for more than a year, requiring no further attention than the replacing of the water as it evaporates. It has the following advantages over the Daniell: it requires only one liquid, very little zinc is employed (the only substance which undergoes alteration in the Léclanché), and does not cause crystallisation a process which, in course of time, interrupts the current. Against these advantages must be set off the fact that this cell is less powerful (for equal surfaces) than the Bunsen, modified Bunsen, or Grove cells, which act with acids; besides the electric current diminishes very rapidly, so that it is necessary to suspend the action of the battery from time to time to enable it to re-charge. But although the Léclanché is not powerful enough for workshops where the work is heavy and constant, it will be found most useful for jewellers and watch gilders who use it only occasionally, and who, owing to the small surfaces they treat, do not require a very strong current. For such light work it will be found preferable to any other. In our next article we shall describe the construction of the Léclanché battery.

(*To be continued.*)

BOOK NOTICES.

Precious Stones: Their History and Mystery. By William Jones, F.S.A. London, 1880. (R. Bentley and Son.)

The fascination which precious stones have exercised over mankind from time immemorial has associated them with much that is interesting and instructive in the annals of persons and events. The superstitions with which precious stones were surrounded, invested them with unusual interest, and as a consequence formed a most prolific theme to the earlier poets and writers. An interesting history of precious stones lies, therefore, scattered over countless volumes known only to the bookworm and the antiquary. Some of these fragments have been carefully gathered together, and judiciously arranged by Mr. Jones, and the result is a most interesting volume of 376 pages, not a single one of which can be called dull; a number of select anecdotes interspersed through the text render it delightful reading. We recommend it to anyone who desires to combine pleasure with instruction in the books he reads.

Electro-plating: A Practical Handbook, including the Practice of Electrotyping. By J. W. Urquhart, C.E. London, 1880. (Crosby, Lockwood and Co.)

The publications on trade subjects issued by Messrs. Crosby, Lockwood and Co., have long and deservedly enjoyed a high reputation, and we can confidently say that the work we are now introducing is a creditable addition. The author handles the subject most lucidly and practically, and the book is printed and illustrated in the good style usual with this firm.

Electro-Metallurgy Practically Treated. By Alexander Watt, F.R.S.S.A. Seventh edition. London, 1880. (Crosby, Lockwood and Co.)

This is a new and enlarged edition of this favourite work on electro-metallurgy; it is too well known to need further notice. We only add that a most important feature in the new edition is the practical information on the electro-deposition of nickel.

THE SILVER TRADE.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—It may fairly be anticipated that the coming abolition of the silver duty and compulsory hall-marking will mark the commencement of a new era of prosperity in the English silver trade.

That there is a taste for the possession of pieces of ornamental plate is clearly shown by the eagerness with which examples that have any just pretentions to be considered old are bought up at extravagant prices. That the existence of this taste has been taken advantage of by persons possessed of more ingenuity than integrity has also been pretty well demonstrated. This phase of the traffic reminds one of the time when the now venerable editor of the *Art Journal*, Mr. S. C. Hall, did such signal service to the cause of art in England by courageously exposing the nefarious dealings in pictures falsely ascribed to the "old masters"; spurious works were disposed of to buyers possessed of more money than culture, and great sums lavished on productions that had no claim to be considered good in any sense of the word. Our native artists found as a rule that their best productions were rated far below those to which a false value had been given by the forgery of great names. But that, like all other forms of falsity, had its day, and English artists are now reaping a rich harvest by the patronage of those who are no longer easily duped by ingenious rogues into purchasing newly manufactured pictures by hands that had ceased to paint hundreds of years ago. It needs no peculiar claim to the gift of prophecy to foresee that there will be a like change in the habits of plate buyers, and that the money which is now often so unwisely given for the possession of a something the sole merit of which, supposing it to be genuine, lies in the fact that its marks prove it to have been made by someone who lived several generations back, may go to the fostering of living talent and enterprise. Silver plate, like everything else that has become interesting in these days, is gradually acquiring a literature of its own, both historic and descriptive. In Mr. Cripps's standard book, "Old English Plate," may be traced the various changes in the fashion of silver work, ranging from the pre-reformation chalice and paten down to the Flaxman tea-urn of the end of the last century, and it is easy to gather, in looking through the series, an impression that in English plate there has generally been a prevalent tendency towards a chaste sobriety in form and decoration. The value of a good collection of characteristic pieces in the projected technical schools cannot be overrated: the traditional qualities of English plate may be retained, though new or unwonted means of decoration may be applied in the old spirit, and thus a school of our own be again developed in accordance with our national habits and tastes.

In commenting on the prevalent craving for the possession of old plate, Mr. Cripps drily observes that "the natural tendency of a demand to create a corresponding supply should never be forgotten by the plate collector any more than by the economist"; and he goes on to give a whole string of instances in which it may be made a question which is most to be wondered at—the mendacity of the vendors, or the simplicity of their dupes. The facetious Mr. Punch, in one of his very early numbers, gives us the semblance of "The baked 'tater man of the fourteenth century"; but the absurdity is almost equalled by one of Mr. Cripps's incidents: a plate collector commissioned an agent to look for a coffee-pot of the Elizabethan period, which, after a reasonable time, was produced to the greenhorn, and had been manufactured from a communion cup of the said period turned upside down to get the proper slope, and then fitted with lid, spout, etc., all to match. By giving publicity to incidents of this kind, the true friends of honest production will serve a good purpose, for we have good authority for saying that traffic of this kind has been carried on on a large scale—it is so easy to do, and so difficult to detect. Mr. Prideaux, the clerk to the Goldsmiths' Company, detailed the successful prosecution of a plate forger to the Commons Committee, and said:—"We received information afterwards that (I was going to say) tons of this plate were taken away and melted down"; and he states his belief that that prosecution "put a stop to this making up of Elizabeth, Queen Anne, and George the First plate for the purpose of satisfying the fancy of antiquaries." He also says that—"So insane was this fancy for purchasing old plate, that I am informed that at that time a man would give for an article with no beauty in it at all, an article of the ugliest description, as much as £4 or £5 an ounce if the mark denoted a remote period—we will say of even Queen Anne; the temptation was so great that it is not to be wondered at that certain people took up this fraudulent branch of trade." That the temptation is great indeed may be further gathered from Mr. Garrard's answer to Question No. 1,213 of the Select Committee:—"What is the particular value of Elizabethan plate? —If you have got a cup of Elizabethan manufacture, which has the hall-mark upon it, I should be very happy to give you £14 an ounce for it." You may perceive there is no stipulation made that it should be a meritorious work, like some of the noble pieces in possession of the City corporations and companies; it may, so far as the words of Mr. Garrard are evidence, be a something that may be best described by parodying the smart speech of sweet Anne Page as she eyes askance her ungainly suitor—"Oh! what a world of vile ill-favoured faults looks handsome if hall-marked for three hundred years!" The Goldsmiths' Company are giving liberally to establish means for the education of skilled workmen; they are supplying wings to aid in raising the trade from out the depression into which it has sunk; but it will be in vain unless they also aid in removing the heavy clogs which so long have weighed it down in the form of duty and compulsory hall-marking regulations. That they will soon disappear from our statute book is the hope and belief of

An Old Hand.

Sheffield, January 19th, 1880.

PERMANENT INTERNATIONAL EXHIBITION IN BRUSSELS.

THE *Palais du Midi*, a handsome and extensive structure, commenced in 1875, is now nearly complete and ready to serve the purpose for which it was built, viz., to accommodate a Permanent International Exhibition of all products of art, industry, and commerce. The building lies in a very central position, between the leading railway stations, and is well connected by tramways with almost every quarter of the city. The undertaking is managed by an influential association of gentlemen of proved skill and experience in the various branches, and the facilities offered to exhibitors will certainly ensure extensive patronage. This association charges itself with the reception, exhibition, and disposal of manufactures, being, in fact, a sort of public commission agent. The Exhibition will be opened on the 1st of May next, and as during the present year the 50th anniversary of Belgian independence is to be celebrated, it will, no doubt, command special attention.

Applications for space and other information in reference to the Permanent International Exhibition should be addressed to M. De Bavay, Administrateur-Directeur, Palais du Midi à Bruxelles. An official pamphlet giving all particulars with illustration of the Exhibition Palace can be obtained on application.

HINTS TO REPAIRERS.

(*Continued from page* 92.)

VOLUMES have been written on the proper pitch of wheels and pinions, scientific curves for the shape of wheel teeth and pinion leaves, and mathematical demonstrations of the proper forms are endless; all of which are necessary and proper for every mechanic to know, though he may never be called upon to produce them. Where there is one who will have occasion to apply such theoretical knowledge there are a hundred who are daily and hourly called upon to change the depthing of wheels and pinions; and of these practical workmen most of them (if they deserve the name of workmen) know by inspection whether the depthings are correct. No man living, be he ever so well versed in the theory and practice of laying out the proper curves of wheel teeth, and giving them the proper pitch, can tell by the eye, aided as it may be by a glass, whether the minute teeth on a wheel which is only three or four millimetres in diameter, conform to the established curve. But he can tell, by good judgment and a little experience, whether the depthing of such small wheels and pinions will work to the best advantage which their shape (whatever it may be) will permit. Any particular hints which will facilitate the correction of such errors in depths as are constantly troubling the practical repairer, may be of benefit to somebody, and whoever feels the want of such hints will be grateful for them.

The present shiftless manner in which cheap watches are constructed is the fruitful source of the troubles referred to. Wheels and pinions are cut, jewels set, and the whole construction of the watch executed with the sole view to *sell.* The universal practice, in modern cheap watch manufacture, is to jewel the escapement, second, third and fourth wheels. The laying out of depths being careless, there is no possible mode of correcting them by the means usually resorted to where the pivot holes are brass. These swindling watches permeate the whole country, and after falling into the hands of buyers it is soon discovered that somebody is wanted to "make them go," and of course the watch repairer must come to the rescue. Nine times out of ten the principal faults are in the depthings. When too deep the remedy is simple; reduce the wheel the requisite amount in size, and round up again. If too shallow, there is no remedy but to increase the diameter of the wheel by some means; the usual way, where no special tools are to be had for the purpose, is to stretch the web of the wheel, true up the points of the teeth in the lathe, and round them up by hand. Theoretically these plans are incorrect, as the proper proportion between diameters has been altered (supposing they were originally correct), and theorists would say nobody but a "botch" would do such a job; don't do it. But the thing must be done—the watch must be made to go—the owner won't pay much for the repairs—and to refuse to do it in such a cheap way as you know will answer the owner's purpose, is but taking bread out of the children's mouths. Consequently it must be done, and the cheapest mode of doing it the best is what is wanted. The neatest and really the quickest way of stretching the teeth, in the absence of a regular stretching tool, is to turn up on the lathe a disk of brass, tin, or any thin metal, a little smaller in diameter than the bottom of the wheel teeth; through the centre of this disk must be a hole large enough to allow the pinion to pass. Slip the disk over the pinion and it will nearly cover the web of the wheel; then with a chisel-shaped punch, the end of which must be a little rounded, go carefully around the disk (the wheel lying flat on a stake), driving the punch into the web slightly, which forces the teeth outward, thus enlarging the wheel's diameter and leaving only a slight groove in the surface of the wheel, which does not disagreeably mar its appearance, particularly if the end of the punch be polished. True up the wheel teeth on their points, round up nicely, and the job will do you no discredit, and will not consume much more time than flattening the teeth on a stake—in fact, not so much, if the wheel be so much hammered as to make it necessary to go through the wheel with an equalling file. On the whole, we think, however, that it is true economy to buy a stretching tool, which is not so expensive as to be beyond the reach of even slender pockets. A rounding-up tool, to follow the stretching tool, is exceedingly convenient, and gives excellent results, but rather expensive for small repairers. Rounding up teeth by hand is a very tedious process, but when carefully done may give very fair results. A piece of wood should be held fast in the vice, and a slit cut in it deep enough to allow the pinion to slip down till the top of the wheel is only a little above the wood; hold the wheel firmly, and be careful to carry the round-up file at right angles to the plane of the wheel; a little practice in rolling it in the fingers will give a very good shape to the wheel teeth.

(*To be continued.*)

ASSOCIATION OF WATCH-MANUFACTURERS IN GENEVA.

THE Watch manufacturers of Geneva have founded an association which has for its object the introduction of a better system of trading. The members, comprising most of the leading houses of that city, pledge themselves to indicate on their invoices the origin and quality of metal and workmanship of all the goods they sell. The public is warned by advertisement and otherwise to demand a detailed invoice when buying a watch, if they wish to prevent imposition. Now this is certainly a most judicious way of dealing with the fraudulent element which has vegetated in that country at the expense of honest manufacturers, and we are glad to hear that they rather trust to these beneficent trade rules than to a Government stamp, which could only anwer for the metal, and, for the more important movement, the public would still be at the mercy of impostors. The association while devoting its energy to improve business morality, or rather morality in business (the former term is rather elastic as generally understood), it will not neglect the technical part of the trade. Anyone at all acquaintted with Geneva knows that that city and its citizens make heavy sacrifices for the watch trade, by training an army of clever workmen, who are the soul of the trade, and on whose skill the Swiss watch trade will always depend. We wish the Watch-manufacturers Association of Geneva every success.

A Novel Theory as to the Origin of Diamonds.—One of Dr. W. B. Fletcher's frogs escaped from his frogarium some time ago, and was found the other day behind a register at his office starved to death, and shrunk to half its former dimensions. The doctor dissected it, and coming to its lungs found these organs clogged with thousands of black crystals which looked like course gunpowder. Under the microscope those crystals presented regular facets with smooth surfaces, presenting the same angle of crystallisation as the diamond. On burning they gave off carbonic acid gas, and they are pure crystals of carbon, as the diamond is. According to the Indianapolis *Herald,* the doctor ingeniously theorizes that in the ages gone by the huge reptiles of the antediluvian period, dying under circumstances similar to those which the frog did, may have formed large crystals of carbon in their lungs which were afterwards transformed into the hard and lustrous diamond.

WATCHMAKERS', JEWELLERS', AND SILVERSMITHS' TRADE SOCIETY.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—I am glad to observe that a feeling is spreading, in the respective trades in the precious metals, that there is an urgent need of a trade society. I do not like the word "Protection," as it is calculated to mislead. It savours of "protection" as against "free trade," whereas it should only mean "protection" as against "fraud"—protection against unfair and impolitic taxation—against licenses—and, above all, against the pernicious influence of compulsory hall-marking, with its attendant delay and inconvenience, which, rightly considered, are taxes of the very worst description.

The primary object of such a society should be to release the trades, with as little delay as possible, from the pernicious effect of old, antiquated, and mischievous legislation. The enforced connection with the Goldsmiths' Company of London is at once a scandal and disgrace to any trade. The connection with the various other Assay offices is but little better. They are, one and all, anti-free-trade institutions. They are barbarous relics of a bygone day, simple representatives of a system which has been condemned not only by the voice of political economy but by the experience of half a century. There is not a single law affecting the trades in the precious metals which ought to remain for another year upon the statute book. What is wanted is a clean sweep—the repeal of every enactment. Not until this has been accomplished will the trades be on a proper basis.

It must be remembered that the conditions of trade are entirely altered. The increase of population alone has revolutionised the system of business. Compulsion is an anachronism, involving a system of *espionage*, without which it is useless—its effect being to reduce trade to a minimum, and to encourage every conceivable form of roguery and deception. I have written over and over again that the Goldsmiths' Company could not, if it would, exercise any proper control over the trades; such a control as would be in accordance with ancient law would involve a travelling police as numerous as Scotland Yard. It would involve a "spy" system which would not be tolerated for a week in this free country. It would be against the spirit of all modern legislation, and its cost alone would prevent its operation. The fact that the law prevails does not stop forgery; it does not stop cheating. It promotes it.

Again, by effluxion of time, the Goldsmiths' Company no longer represents the craft. It is simply a "City Club," like other companies. It is a club with unlimited funds at command, which the favoured few, the members of the Court—be it remembered, a self-elected and self-created Court—administer without the slightest degree of responsibility. To show the utter disregard of the Company as respects their duties and responsibilities, I met in a leading paper, but a few days ago, their name in a list of annual subscriptions of two hundred guineas to the "Irish Church Sustentation Fund!" Shade of Sir Martin Bowes! Shade of Sir Hugh Myddleton! Come forth! A short time ago, having more money than they knew what to do with, they built a church and endowed it, appointing the son of their senior member as first incumbent. They spent some thousands a year in exhibitions to the universities of Oxford and Cambridge, which are given away to sons of professional men and others—a certain number being reserved for sons of clergymen! Let us not forget that every single sixpence of this money was left, by pious founders, for the benefit, for ever, of the trades of the goldsmith and silversmith. Their ancient charters direct that the wardens shall be "elected by the trade," and that they shall be "honest, true, and sufficient men, best skilled in the said trade." As a fact, they create and elect themselves, and, as a rule, know nothing whatever of "the said trade." During the last thirty years it has but very rarely happened that one of the four wardens has been a craftsman. Indeed, to be a craftsman is a positive disqualification for membership. And yet these are the men who exercise precisely the same rights of control over the trades as they did, as a corporation, five hundred years ago, when every single member was ,a goldsmith or a silversmith, Surely there is work for a trade society to sever themselves and their brethren from such an unholy alliance.

That a voluntary system of hall-marking will be of use to the trades is admitted on all hands. The institution of such a system would be one of the earliest duties of a trade society. We must get rid of the "date" mark, and the "town" mark. We must abolish the system of the "scrape and parting assay." Nothing can be easier.

As a first step we want a deputation to the Government. If this Government will not listen to us, the next may. If there be a Government of which Mr. Goschen is a member, we are sure of success, as shown by his cordial support of Mr. Hankey's draft report for the Select Committee of the House of Commons. It was only lost, on a division, by one! This fact speaks for itself.

I have the honour to be, Sir,
Your obedient servant,
Edward J. Watherston.

12, Pall Mall East, London.
February 1, 1880.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—I have carefully read over the correspondence regarding the protection of our trade, and feel delighted with the remarks made by Mr. Greenhow, "Fairplay," and "M.S." I really cannot add anything of my own, but beg to endorse their opinions fully. As we in this quarter of the world feel the effects of the nefarious trade as well as our brethren elsewhere, I would be well pleased to see the Society in working order, being fully satisfied that something ought to be done to keep the trade in its legitimate position, and will contribute cheerfully for the furtherance of the object to be attained.

I am, Sir,
Yours very truly,
Tweedside.

January 8th, 1880.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Dear Sir,—I experience all the evils alluded to by your correspondent, "Fairplay," and would gladly adopt his proposed remedy, only, as he says, others will repair these rubbishing watches, and by refusing to do them we most likely lose the customer altogether. There is another way in which these unprincipled dealers in watches, &c., have a great advantage over *honest* watchmakers and also cheat the revenue. It is by carrying two or three new or second-hand watches or chains, and offering them to anyone they come in contact with likely to buy; by so doing I should say a hawker's license is required. In nearly all cases these men have no license at all. Even if they had a plate license no honest fair-dealing watchmaker will hawk his goods in public-houses, &c., &c. In fact, he has no time if he should have the disposition. Where would his work be at the end of the week. The persons I allude to have generally some other business to rely on, and plenty of spare time. If we could find out some plan of bringing these unprincipled men to justice without the actual informant being exposed, I think that would be a decided step towards reducing their number and securing what honestly belongs to the bonâ fide watchmaker. As one correspondent says, no one likes to personally inform, especially in small towns where everyone knows everyone; to do so, you would be considered mean by people who don't know the nature of these evils.

I am anxious to do what I can to encourage this movement, and I am heartily glad to see that you take so deep an interest in it. Trusting it will go on and have the desired effect,

I am, yours respectfully,
Charles Ankers.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—Now that the idea of a trade society has been fairly started in your excellent Journal, I trust that the matter will be taken up vigorously by all who have an interest in the movement. "In the multitude of counsellors there is wisdom"; and if those who have a knowledge of new abuses, or remedies to suggest for old ones, will come forward and ventilate the matter in your columns, I think we shall soon see that there is likely to be plenty of work cut out for the society which it is proposed to form.

I remember that when I went to school, one of our reading lessons on "Capital and Labour" commenced thus:—"A carpenter earns more than a ploughman, and a *watchmaker more than either*"; but really, unless we follow the example of other trades, and "organise," the accuracy of that statement will soon have to be called in question; for during the past few years some very important changes have taken place in the conduct of business, many of them injuriously affecting the members of our trade, and although it is doubtless true that watchmakers and jewellers must to some extent accommodate themselves to altered circumstances, yet many evils have arisen that can, and ought to be, suppressed.

Amongst these may be mentioned the advertising swindles in connection with the watch trade, and the recently developed hawking system alluded to by "Fairplay" in your issue for January. No advertiser can be blamed for giving the best possible *truthful* description of his wares, and a considerable margin for exaggeration would probably be allowed by general consent; but the line ought to be drawn somewhere, and I think that the persons who make it answer their purpose to spend large snms every week in advertising low class goods as "the best that money can purchase" require as much looking after as the man who sells his "butterine" as butter, or who supplies any other commodity of a quality inferior to that demanded or expected by the purchaser.

If any of your readers are unacquainted with the trickery commonly practised by the modern order of itinerant watch dealers, I would recommend them to procure the "Delightful Dentist," a satirical sketch, in which the doings of some of these gentry, together with the unlimited gullibility of the British public, are amusingly set forth.

In order to make out a good case for himself it is generally necessary for the hawker to malign and misrepresent the local watchmakers, and this is usually done with impunity, and with an audacity that the members of few other trades would tolerate.

I have, however, by me a report of a case in which a watchmaker, whose name was pretty freely handled in this way, took the matter up, and brought an action for slander, in which he was awarded heavy damages.

So long as the trade stand silently by these systems will continue to grow and prosper; but I believe that were a properly organised opposition offered, they would soon be annihilated; for although the credulous section of the public are free with their money so long as their confidence in the dealer remains unshaken, let but a breath of suspicion cross their minds that deception is being practised, and *the majority become afraid to "speculate"*—the game ceases to PAY, and the dealer betakes himself to "fresh fields, and pastures new."

To follow up, expose (by suitable handbills or otherwise), and, where possible, prosecute all tricksters, would furnish good work for a trade society, and with such an object in view surely no member of the trade would refuse his contribution towards the expenses of the association.

These dealers not only flood the country with worthless watches, but they destroy the good relations which should exist between a tradesman and his customers. The most dangerous falsehood is the one that is half a truth; and after listening to a profound lecture which professes to reveal all the secrets of the watch trade, your customer, albeit hopelessly befogged, feels himself quite competent to dictate the prices at which you are to undertake his work. Finding, for instance, that his cheap Jack watch resembles Captain Cuttle's, in that it requires to be put back half an hour at night, and another half hour in the morning, he will tell you (as one of mine did) that he considers two shillings an exorbitant charge for a new hair-spring, as he can buy them for a penny or twopence a dozen. Of course it is open for you to explain, if you think it worth while to do so; but when you are conscious of making a perfectly fair, and even moderate charge, nothing is more unpleasant than to feel that your customer views you with suspicion, and more than half believes you are a rogue.

As regards undertaking the repair of these inferior watches, some diversity of opinion exists. Many, in common with your correspondent "Fairplay," advocate the refusal of them altogether, and although I am not in favour of that course, I should be willing to go with the majority. The plan would be most effectual *if perfect unanimity could be ensured*, but that I very much doubt, for it is not every one who can *afford* to refuse work when it is offered. If the work is undertaken without comment, there is an implied contract to make the watch go, but this, as "Fairplay" observes is not always an easy matter. I would therefore suggest that when watches below a certain standard are brought for repair, the owners be distinctly given to understand that the work will be *charged according to the time and trouble expended on it*, but that *no guarantee for performance can be given*, and that should the article afterwards require attention *fresh charges must be made on each occasion*. Owners of bad watches would then, I think, soon become disgusted with them.

Trusting that the discussion of these matters will lead to some speedy and decided action being taken,

I am, Sir, yours sincerely,
Sperans.

Precious Metal Trades in the United States. — Our American contemporary, the *Jeweller's Circular*, speaks very hopefully of the prospects of the jewellery trade in the United States. Our authority states that business has been very brisk for the last six months, especially in standard goods; in fact, manufacturers were unable to complete their orders. The leading houses in the silver-plated ware line were obliged to recall their travellers and to decline orders on account of their inability to supply the goods. From another source we learn that the watch factories are all in full swing, and with orders to spare, and that Coventry has been called in to assist in completing them. If all this is correct, as we hope it is, the editor of the above-named journal may well congratulate his readers; we wish we could do the same for ours.

THE MANUFACTURE OF DIAMONDS.

THE startling announcement that Mr. James Mactear, of Glasgow, had succeeded in producing crystalline carbon has naturally excited a great deal of interest, and given rise to much correspondence in the columns of the *Times*. We already stated in our last that Mr. Mactear's products did not stand the tests to which they were subjected by Mr. Maskelyne; but it appears that that gentleman's experiments were not exhaustive. Further investigation has shown that Mr. Maskelyne's estimate of the substances submitted was so far correct that they are not crystalline carbon, but resemble it so closely in many respects that they will be of commercial value even in their present condition, capable of replacing diamond-dust in many of its uses in the arts. A portion of the material is said to be very hard, in fact hard enough to scratch topaz and sapphire and to abrade diamonds. These assertions are borne out by certificates from Mr. B. Boam, diamond merchant; Mr. Thomas Boston, seal cutter and gem engraver; Mr. William Simpson; and Mr. J. T. Fulton, of Messrs. Muirhead and Sons, jewellers and diamond merchants, all of Glasgow.

Mr. Maskelyne feels sure that the artificial manufacture of diamonds will be accomplished some day, an opinion which is shared by another correspondent, Mr. J. Percy. This gentleman writes:—

"I agree with Mr. Maskelyne in thinking there is reason to expect that the diamond will some day be artificially produced. But, if so, possibly a very long period will be required to form a crystal of sufficient size and quality to be of any commercial value. Alumina, the substance of sapphire and ruby, has long ago been crystallized, yet to this day no artificial sapphire or ruby worth a farthing has appeared in the market. The balas ruby, or red spinel, was formed about 40 years ago by Ebelmen in small but distinct crystals, of which I have specimens in my collection, yet, so far as I am aware, the natural gem is alone known to jewellers. The conditions under which nature has crystallized carbon in the cubical system must be extraordinarily rare, seeing that a small room would probably suffice to contain all the diamonds that have hitherto been discovered. The possessors of diamonds have not at present any reason to fear that the value of their property will be lowered by the crystallized carbon of the chemical laboratory."

A Parisian manufacturer of artificial diamonds, in forwarding a specimen of his manufacture to the editor of the paper we quote, says:—

"The stone I send for your inspection cannot possibly be distinguished from a genuine diamond by an ordinary observer.

"Similar stones to these have successfully stood the test of public opinion for some time past since they were introduced into England by a firm at the West End under the name of 'Diamanté' brilliants.

"These stones are not reproductions of real diamonds effected by chemical means, but are simply artificial stones of absolutely perfect manufacture, produced by a new process; and apart from their relatively infinitesimal intrinsic value they successfully fulfil all the purposes for which real diamonds, even of first quality, are utilised. The stone enclosed would, if real, be worth £200, but can be sold for a few shillings, and similar artificial stones mounted in gold with the best workmanship will past muster, and even close scrutiny, anywhere and under all circumstances. And what further can be desired?

"I submit, then, that the perfection attainable by modern art has already resulted in the production of perfect substitutes for the diamond upon conditions which place them in future within the reach of all classes."

Although Mr. Mactear has not as yet succeeded in obtaining crystalline carbon, he appears to have full faith in the ultimate result of his labours. From a lengthy communication of his to the *Times*, under date January the 16th, we cull the following:—

"A fresh investigation of the nature of the crystalline substance has been completed after a series of experiments which have occupied four days; and I now feel it my duty both to Mr. Maskelyne and myself to say that the crystalline substance which I believed to be carbon in that condition is not so, but that, while it very strongly resembles Brazilian boart, or diamond-dust, it consists almost entirely of silica and alumina and a small amount of magnesia, as well as a residue insoluble in hydrofluoric acid, even after the action had been prolonged over more than 48 hours. This residue, fused with caustic soda, still contained a few minute crystalline forms and particles of what we assume to be carbon in some graphitic form, which burns away on the application of a strong heat.

"This latter residue I trust still further to examine, when I shall have obtained a larger quantity of material on which to work.

"It is at the same time due to myself to explain that the theory upon which my experiments were based with the view of obtaining carbon in its crystalline modification is by no means unsound or even shaken by the non-success of the recent experiments. I have Mr. Maskelyne's authority to state that he thinks it far from improbable that by some modification of these experiments the desired result may yet be obtained, and he encourages me strongly to go on in the line of inquiry I had mapped out for myself.

"Working on what I yet consider a perfectly sound theory, and with materials usually considered to be beyond suspicion of impurity, I obtained a crystalline substance which is so like diamond-dust in appearance even under a high power of the microscope as to deceive even experts. It resisted the action of acids and strong alkaline solutions as well as a high degree of heat, and at least a portion of it is hard enough not only to cut class, but to scratch sapphire, ruby, and some other gems, not excepting even the diamond itself. The effect produced on exposing the particles to the electric discharge in a vacuous tube (an experiment kindly tried for me by my friend Mr. Crookes, F.R.S., the well-known chemist) is so similar in appearance to that produced with Brazilian diamonds or even boart—the crystals glowing or phosphorescing with the most beautiful colours, such as pale-blue, orange, apricot, and yellowish-green—that Mr. Crookes stated to me that had he not known from me the history of the little fragments, he should have declared them to be small fragments of Brazilian boart, or diamond.

"The presence of carbon in some graphitic form will serve to explain the difference of opinion as to the combustibility of the substance, as, while a portion undoubtedly burns away, another, and by far the larger portion of the sample of crystalline substance we have been working upon, is little or not at all affected by a very high temperature.

"I would beg to point out that while announcing my belief that I had produced carbon in its crystalline modification I courted the fullest possible inquiry. With this view I, on the 16th of December last, before making my results public, sought Mr. Maskelyne (as the greatest authority on diamonds), and, although unsuccessful in finding him, left him a specimen of my product for his inspection with Mr. Warrington Smyth, who kindly undertook its delivery, and subsequently I wrote to him offering to explain my methods and theory should he wish it.

"Many of my scientific friends, like myself, were led to conclude, from the hardness and general appearance of the crystalline material, that the experiments had been successful, although it would now seem that the particles so like diamond 'boart' are a mixture of substances of the nature of sapphire, spinel, and possibly corundum, with a little graphitic carbon.

"I can scarcely hold myself responsible for the somewhat extravagant ideas which have appeared on this subject, as I do not believe that it is likely, or even probable, that diamonds of any size will be produced artificially: the formation of crystal of even one carat in weight must represent an action of a very long period indeed. But I do most firmly believe that the time is far from distant when crystalline carbon in form of dust or sand, such as I still hope to produce, will be obtained in quantity, and will have before it a great future in the arts.

"That my announcement was made in perfect good faith, and based, not on haphazard, but carefully devised experiments, and on results which even to diamond experts seemed convincing, Mr. Maskelyne admits. But in science truth should be the one great aim; and while I most frankly admit that in this case my experiments have resulted in failure, in so far as the production of crystalline carbon is concerned, yet the obtaining of substances closely resembling it in so many respects, and which seem actually to be of the nature of sapphire and ruby, is sufficiently interesting and gives encouragement to continue the investigation, which, sooner or later, I am certain, will be successful."

THE FRENCH AND SWISS WATCH TRADES.

"SWISS papers," says the Geneva correspondent of the *Times*, "are calling attention to the rapid growth of the French watch trade, and one of them has recently published some interesting figures which attest the extraordinary progress that has been made during the last 30 years, especially at Besançon, the headquarters of the industry. Official returns show that the watches made there in the five years between 1845 and 1849 numbered, in all, 239,323, of which 37,149 were of gold, and 202,174 of silver. In the following five years these numbers were almost doubled, amounting to 405,181, while in the next five (1855-59) the quantity manufactured was 861,652, of which 550,508 were silver, and 311,144 gold. From that time to this, except in 1877 and 1878, when there was a slight falling off as compared with 1876, the production has gone on steadily increasing. In 1875, the outturn was 419,984; in 1876, 455,968; and in 1878, 454,886. In the last-named year alone the production was more than double that of the five years from 1845-49. It is a circumstance worthy of note, as showing either a change of fashion or a notable increase in the number of persons able to afford themselves more costly timekeepers, that, whereas 30 years ago the proportion of gold to silver watches produced was one-fifth, it had risen in 1870-4 to more than one-half: and, though it has since somewhat sunk, the variation is not considerable, 147,380 gold watches against 307,258 silver ones having been turned out in 1878. The value of them is not officially stated, but, as the average worth of a gold watch is 85f. and a silver one 25f., we may safely conclude that the yearly production of Besançon and the neighbourhood reaches 20,200,000f. (£808,000). As the total number of watches produced in France in 1878 was 520,438, it follows that 87·40 per cent. were made at Besançon. Nearly all these were for home consumption, the quantity sold by Besançon houses for export amounting only to 1,131, of which 541 were of gold. The trade in watches between France and Switzerland seems to have greatly altered in character during the last few years, as will be evident from the following figures:—In 1862-4, the exports from Switzerland to France were 1,301,522 silver and 2,769,840 gold watches and 25,962 movements: total, 4,097,324. In 1872-4, the exports consisted of 545,261 silver and 265,869 gold watches and 617,782 works: total, 1,428,912. The exports from France to Switzerland, on the other hand, which in 1862-4 showed a total of only 337,796 watches and movements, reached in 1872-4 a total of 1,642,364, of which 239,393 were silver and 330,329 gold watches and 1,072,642 movements—an enormous, and (if we could accept these figures as entirely trustworthy), for the Swiss watch trade, a portentous, increase, coinciding as it does with a falling off in Swiss exports to France. But there is good reason to believe that they are altogether illusory and misleading, inasmuch as the compilers of them have taken no account of the enormous clandestine commerce that is always going on between the two countries, and which, stimulated by the French system of drawbacks on exports of gold and silver ware, was inordinately active in 1872-4 and two or three years thereafter. In France all objects made from the precious metals are 'controlled' (a process analogous to 'hall-marking') and taxed. On such of them as are exported a drawback equivalent to the amount of the tax is allowed by the Custom-house. Certain Swiss and French watchmakers, jewellers, and others ingeniously turned this system to profit by smuggling into France articles on which the drawback had already been paid, exporting them a second, and even a third time, and receiving as many drawbacks, the only evidence of origin required by the French Custom-house officers at the frontier being the stamp of the 'control.' This business prospered exceedingly for a considerable time, and when it was accidentally discovered two years since, several very respectable houses were found to be deeply implicated in it. In some instances, however, restitution was made to the French Government by the parties concerned, and means were taken to check the practice for the future. How far they have been effectual it is difficult to say, as, owing to the character of the frontier between France and Switzerland, nothing is easier than to smuggle light articles from the one country to the other; and when their intrinsic value is great and the duties on them are heavy, contraband trading cannot be prevented. Smuggling is still extensively carried on from Tessin into Italy, notwithstanding all the efforts of the Italian Government to crush it. The more effectually to carry on the business, the people on the border have formed themselves into joint-stock or co-operative companies. They have a common fund, share equally in the profit of their ventures, and if one of the company be caught and fined, the others pay the fine and keep his family until he is released from custody. Hence, official statistics relative to the trade in watches and other articles of price between Switerland and neighbouring countries must be taken as revealing only a part of the truth, and that sometimes in so distorted a shape as to give rise to all sorts of erroneous conclusions."

Wages in France.—Statistics have been published by order of the French Government, in the *Annuaire Statistique*, with reference to the number of men engaged in the various branches of industry, the total production, and the wages earned. From these reports it appears that in the provinces gold and silversmiths and jewellers receive from 2s. 1d. per diem, with board; watchmakers, from 1s. 8d.; while without board they are paid from 4s. 3d. per day. In Paris the average daily wage of these trades is 9s. 2d.

Artificial Onyx.—A process for converting common agate into the beautifully banded onyx stone has been recently invented in Germany. The agate is first coloured red by immersion for a week or more in a corrosive solution of iron in aquafortis. The places to be blanched are then impregnated for the same length of time, with a corrosive solution of one part carbonate of potash, and one part caustic potash, dissolved in water. After that the stones are dried for a week at a moderate warmth, and finally exposed in a closed earthenware vessel to the high temperature of a red-hot furnace.

THE
Watchmaker, Jeweller, & Silversmith,
A MONTHLY TRADE JOURNAL,

Devoted to the interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades; published at Milner's Buildings, Moorgate Street (Opposite Moorgate Street Station), London, E.C. Booksellers and Newsagents supplied by Messrs. Catty & Co., 12, Ave Maria Lane, Paternoster Row, E.C.

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MONTHLY RECORD OF BANKRUPTCIES.

Declarations of Dividends, Dissolutions of Partnerships, Scotch Sequestrations, &c., &c., relating to the various Trades represented in this Journal.

Liquidations by Arrangement or Composition.

Raphael, Joseph, Howard's Hotel, St. James' Place, Aldgate, hotel keeper, diamond merchant, and jeweller. Jan. 2. J. Emanuel and Co., sols., 27, Walbrook.

Wilson, John, London Road, late High Street, Sheffield, jeweller. Jan. 3. Broomhead, Wightman, & Moore, sols., Sheffield.

Kidd, Emila, trading as E. Kidd & Co., Bath Row, Birmingham, electroplater. Jan. 5. R. Taylor, sol., Colmore Row, Birmingham.

Nuttall, Robert, Lower Hillgate, Stockport, watchmaker. Jan. 8. F. Newton, sol., Stockport.

Laval, Luc, Great Portland Street, watchmaker. Jan. 12. J. Mandale, sol., Mitre Court, Fleet Street.

Marks, Henry, 198, Mile-end Road, late Hastings, clothier, and trading as Mdme. Marks, King's Road and Park Crescent, Brighton, jeweller. Jan. 17. At Edmonds, Davis & Co., 98, Cheapside. Feb. 10 at 12. Smith, Fawden, & Low, sols., 12, Bread Street.

Mercer, Joseph Barnes, Hearsall Terrace, Chapel Fields, Coventry, watch manufacturer. Jan. 16. O. Minster, sol., Coventry.

Wood, James William, Park Street, Bristol, jeweller. Jan 13. F. W. Tonkin, sol.

Hammerson, Nathan Philip, 26, Clerkenwell Road, jeweller. Jan. 22. At Wedlake & Letts, sols., Mitre Court, Temple, Feb. 9 at 2.

Knowles, William, Church Street, Hampton, jeweller. Jan. 22. At Laundy & Sons, sols., 5, Cecil Street, Strand, Feb. 11 at 2.

Lee, John, Demesne Road, Withington, near Manchester, John Dalton Street & Deansgate, Manchester, jeweller and dealer in musical instruments and works of art. Jan. 20. At Kellas, Johnstone & Kendal's, 16, Kennedy Street, Manchester, Feb. 12 at 12. R. A. Gartside, sol.

Wiggins, John, trading as John Wiggins & Sons, Claremont Road, Handsworth, Staffs, jeweller. Jan. 21. At C. Davies', sol., Bennett's Hill, Birmingham, Feb. 6 at 3.

Norman, Charles, St. Ives, watchmaker. Jan. 23. At W. Watts, sol., St. Ives, Feb. 11 at 2½.

Dissolutions of Partnership.

Hammerson & Reich, Clerkenwell Road, watch and clock importers and opticians. Dec. 24. Debts by Nathan P. Hammerson.

Harker & Betteridge, Wardour Street, Soho, jewel-case makers. Dec. 31. Debts by William Betteridge.

Trustees Appointed.

Rowley, Alfred, trading as A. & S. Rowley (Liq), Clerkenwell Road, and Kirby Street, Hatton Garden, diamond merchant. Tr., T. Cartwright, 173, Hockley, Birmingham, manufacturing jeweller.

Dividends.

Orams, Jeremiah K., (Liq), Chelmsford, jeweller. Div. 1s. 8d.; F. B. Leeming, 10, Coleman Street.

PATENTS.

United States of America.

222,377. Willard L. Bundy, of Auburn, N.Y., for "Calendar-clocks."—Application filed 18th March, 1879.

222,424. Charles Shepherd, of Alexandra Road, St. John's Wood, county of Middlesex, Great Britain, for "Electro-magnetic clocks."—Application filed 4th June, 1879.—Patented in England, 20th June, 1878.

222,460. Charles P. Corless, of Elgin, Ill., assignor to the Elgin National Watch Company, for "Dial attachments for stem-winding watches."—Application filed 15th October, 1879.

222,657. D. Azro A. Buek, of Waterbury, Conn., assignor to himself and Edward A. Locke, of the same place, for "A stem-winding attachment for watches."—Application filed 28th September, 1879.

222,658. D. Azro A. Buck, of Waterbury, Conn., assignor to himself and Edward A. Locke, of the same place, for "A watch-dial."—Application filed 26th September, 1879.

Patents Granted in Foreign States.

France.

131,638. Gilot, of Perpignan, for "So-called 'mysterious cylinder watches.'"—Dated 10th July, 1879.—Class 12.

131,703. Kieffer, for "Fastenings for jewellery."—Dated 11th July, 1879.—Class 17.

131,824. Collin, of Paris, for "Regulating clocks by electricity."—Dated 19th July, 1879.—Class 12.

131,890. Maurel, for "Fastenings for jewellery."—Dated 19th July, 1879.—Class 17.

131,938. Jodry, of Besançon, for "A remontoir for watches."—Dated 30th July, 1879.—Class 12.

132,000. Junghans, Brothers, for "A perpetual calendar motion, applicable to clockwork in general."—Dated 29th July, 1879.—Class 12.

132,047. Gallerand, of Paris, for "Chased decorations enamelled on gold articles."—Dated 31st July, 1879.—Class 17.

131,115. Millot, for "Stop for the star-wheel and snail of time-pieces."—Dated 7th August, 1879.—Class 12.

132,073. Liagre, for "A convex lens for watchmakers and jewellers."—Dated 2nd August, 1879.—Class 12.

Belgium.

49,427. T. Weisser, for "A clock with a single motor."—Dated 29th September, 1879.

49,536*b*. F. Deprez, of Liége, for "Dial-plates with luminous figures."—Dated 13th October, 1879.

49,733*b*. Bellosa and Mahla, for "Rings that can be converted into earrings."—Dated 3rd November, 1879.

49,821. J. F. N. Maeay, for "Improvements in the production of colcothar or jewellers' rouge (ferric oxide) and cupric chloride."—Dated 14th November, 1879.—English Patent, 17th October, 1879.

49,933. A. Lion, for "Manufacturing bracelets, necklaces, &c."—Dated 26th November, 1879.—Original Patent, 9th June, 1879.

49,977. A. Casse, for "Manufacturing gimp of gold, silver, or other metal thread."—Dated 3rd December, 1879.—French Patent, 22nd November, 1879.

Austria.

1430. D. A. A. Buck, of Worcester (U.S.), for "Improvements in clocks."—Dated 11th May, 1879.—Class 7.—American Patent, 21st May, 1878.

1773. M. Fauner, for "A construction of pendulum repeating clocks."—Dated 22nd March, 1879.—Class 7.

1851. C. Krauss, for "A disengaging gear for electric clocks."—Dated 22nd March, 1879.—Class 7.

1936. R. Speltz, for "Fastening earrings."—Dated 23rd March, 1879.—Class 7.

2081. E. Fareot, for "A remontoir system for pendulum clocks."—Dated 21st April, 1879.—Class 7.

2668. O. Steiner, for "A remontoir for spring pendulum clocks."—Dated 3rd May, 1879.—Class 7.

German Empire.

4059. "A construction of watches."—Class 83.

7986. S. Abrahamsohn, of Berlin, for "A holder for opera-glasses and other eye-glasses."—Dated 30th March, 1879.—Class 42.

8639. A. Paetow and W. Rohde, of Berlin, for "A contrivance in watches or clocks for preventing over-winding."—Dated 7th August, 1879.—Class 83.

8666. W. J. Pfaff, of Leipzig, for "Modifications in remontoir watches with a regulator."—Dated 7th August, 1879.—Class 83.

4276. "A construction of clocks."—Class 83.

Patents Sealed.

2743. William Henry Read, of White Street, Coventry, in the county of Warwick, for an invention of "Improvements in keyless watches."—Dated 5th July, 1879.

3017. Alexander Melville Clark, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, for an invention of "Improvements in keyless watches."—A communication to him from abroad by Pauline Gontard, of Cortébert, Switzerland.—Dated 24th July, 1879.

Notices to Proceed.

5020. Ebenezer Dobell, of 21, Robertson Street, Hastings, in the county of Sussex, jeweller, has given notice in respect of the invention of "An improvement in 'solitaires.'"

Grants of Provisional Protection for Six Months.

5100. To Thomas Heath, of Birmingham, in the county of Warwick, Jewel-Case Manufacturer, for the invention of "Certain improvements in cases for holding jewels, gold, silver, or electro-plate ware."

5307. To Friedrich Hermann Felix Engel, Civil Engineer and Patent Agent, in the city of Hamburg, Germany, for the invention of "Improvements in apparatus and in the arrangement of mechanism for winding up ordinary and keyless watches."—A communication to him from Wilhelm Gülzow, of Hamburg, in the German empire.

Patents which have become Void.

191. Harrison Mill Frodsham, of the Strand, in the county of Middlesex, Chronometer Maker, for an invention of "Improvements in equimotive escapements for watches, clocks, and other time-keepers."—Dated 15th January, 1877.

Applications for Letters Patent.

5328. Edwin Ambrose Brydges, of the firm Brydges and Co., Patent Agents, of 32, Belle Alliance Strasse, in the City of Berlin and empire of Germany, for an invention of "Improvements in chronometer movements, applicable to marine chronometers, watches, astronomical and other timekeepers."—A communication to him by August Ernst Müller and Johann Pollak, both of the city of Vienna, in Austria.—Dated 31st December, 1879.

119. George Evans, of Clerkenwell, in the county of Middlesex, for an invention of "Improvements in solitaires and studs."—Dated 10th January, 1880.

303. William Morgan-Brown, of the firm of Brandon and Morgan-Brown, Engineers and Patent Agents, of 38, Southampton Buildings, London, and 1, Rue Laffitte, Paris, for an invention of "Improvements in telephone signal apparatus, and in keeping clocks in unison."—A communication to him from abroad by George Henry Bliss, of Pittsfield, Berkshire, Massachusetts, United States of America.—Dated 23rd January, 1880.

Sapphires are likely to improve in value in consequence of the withdrawal of the British Residency from Burmah. Large quantities of sapphires are exported from that country to England and the Continent; but the stoppage of friendly intercourse is sure to affect the supply.

Failures in the Jewellery and Watch Trades.—From *Kemp's* Statistical Abstract of Failures in England and Wales for the year 1879, we gather that 276 jewellers and watchmakers have succumbed to the bad times during the past year, and were obliged to seek relief in the Bankruptcy Court. Since August there has been a marked decrease in the number of failures, six being the highest weekly number. During the last five weeks there have only been 11 failures, about the average number of bankruptcies in these trades in the most prosperous times.

Diamond and Pearl Making.—There is in Paris a vast establishment—the most extensive of its kind in the world—where the imitation of pearls, diamonds, and precious stones generally is carried on with all the skill which modern ingenuity renders possible, and whose productions are sent to the shops of all lands. Here the whole process of transforming a few grains of dirty heavy-looking sand into diamonds of sparkling hue is constantly going on. The sand thus employed, and upon which the whole art depends, is found in the forests of Fontainebleau; it appears to possess some peculiar qualities of adaptation to this purpose.

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CONCH PEARLS.

Most readers, says the *Scientific American*, have doubtless frequently seen and admired the delicately tinted, pink-faced shells which are extensively used for bordering garden-walks and other ornamental purposes; but few probably are aware that in the conch which forms and inhabits this shell is occasionally found a very lovely gem, known to lapidaries as the conch pearl. When perfect, the pearl is either round or egg-shaped and somewhat larger than a pea, of a beautiful rose colour, and watered; that is, presenting, when held to the light, the sheeny, wavy appearance of watered silk. It is, however, a very rare circumstance to find a pearl which possesses all the requirements that constitute a perfect gem, and when such does happen it proves an exceedingly valuable prize to its fortunate finder. A good pearl is very valuable indeed, some having been sold in Nassau for no less a sum than four hundred dollars. Although many of these pearls are annually obtained by the fisherman in the Bahamas, not more than one in twenty proves to be a really good gem, and hence probably their high price.

Pink is the most common and only desirable colour, although white, yellow, and brown pearls are occasionally found. Even among the pink ones there is usually some defect which mars their beauty and materially injures them; some are very irregular in shape and covered apparently with knobs or protuberances; others are too small, while many lack the watering, which gives them their great value and chief beauty. The conch abounds in the waters of the Bahamas, and thousands of them are annually obtained and destroyed for their shells, which form quite an article of commerce, but in not one conch in a thousand is a pearl found. When this is taken into account, and the other fact, that not more than one in twenty of pearls found turns out to be perfect, it will at once be seen that a good conch pearl will always be a rare and costly gem. In fact, their value within the last few years has almost doubled, and the demand for them is steadily increasing. Most of the conch pearls found in the Bahamas are exported to London, where they are readily sold. A few have been sent to New York, having been purchased in Nassau by an agent of Messrs. Tiffany & Co., the well-known jewellers.

Like everything else that is valuable, the conch pearl has been imitated, and some of the imitations have been sold as the genuine article. Many years ago an ingenious American visited Nassau and conceived the idea of making conch pearls. He succeeded admirably in cutting out of the pink portion of the shell some very creditable imitations. To make success doubly sure, he procured a number of the live shell-fish, carefully inserted his spurious pearls in the position in which the genuine pearls is usually found, and placed the fish in an inclosed place in the water. At the expiration of a month or more the fish were again removed, and, of course, pearls found in them, several of which were sold to inexperienced persons before the fraud was detected. It was detected, however, and the perpetrator received prompt and deserved punishment.

The colouring matter for imitating emeralds, rubies and sapphires is entirely mineral, and has been brought to high perfection. Hundreds of operatives are employed in polishing the coloured stones, and in lining the false pearls with fish scales and wax. The scales of the roach and dace are chiefly employed for the latter purpose. They have to be stripped from the flesh while living, or the glistening hue so much admired in the real pearl will not be imitated. These Paris pearls have been of late years so perfect that the Roman pearl has, to a certain extent, been superseded. The setting is always of real gold, and the fashion of the newest kind.

A Chicago firm advertises watches in a well-known American scientific paper at 2 dols. each. They are said to be *the cheapest in the known world.*

Anklets.—A leading fashion paper says that January is not the time for any radical changes in shapes or materials, but it produces many novelties in the smaller details of la mode, and certainly the most notable of these is the wearing of anklets. This fashion, so rapidly gaining favour among the aristocracy—to which class its adoption will be confined (we hope so)—owes its introduction to the short ball dresses, and there is no doubt the two will eventually serve to keep each other in existence. The elaborately embroidered stockings and profusely decorated shoes of the present day are too becoming to the wearers, and far too elegant a finish to the toilette to be lightly discarded, and the *ne plus ultra* of distinction and elegance is reached by the addition of silver or gold anklets, with pendants of the same or of jewels.

It is said that the diamond trade is looking up, owing to large demands from America.

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W H TILBY

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CONTENTS.

	PAGE
The Construction of a Simple but Mechanically Perfect Watch	111
Prize Essay on Watch Tools	112
Practical Instructions to Jewellers, Silversmiths and Electro-platers	113
Watchmakers', Jewellers', and Silversmiths' Trade Society	113
Goldsmiths' Hall, London	114
Electric Time Ball for India	114
Queries and Answers	115
Two more Claimants for the Artificial Production of Diamonds	115
Hints to Repairers	116
Her Majesty's State Crown	116
Exhibition of Gold and Silver Work, Jewellery, Precious Stones, Clockwork, and of the Tools used in their Manufacture	117
Table for Approximately Converting the English Decimal Ounce with the Continental Gram Weights	117
The Silver Trade	118
Artists and the Silver Trade	119
British Silver	119
Antique Plate	120
Technical Education	121
Monthly Record of Bankruptcies	122
Patents	122
Watchmakers' School at Glasshuette (Saxony)	124
Directory	ii
Advertisements	i-x

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THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.*

By M. Grossmann, Watch Manufacturer, Glashuette (Saxony).

[It is hardly necessary for us to introduce the writer of this essay to our readers, as anyone at all acquainted with horological literature is familiar with his name. There are probably few watchmakers who have not read his able "Treatise on the Lever Escapement," which received the prize of the British Horological Institute, a compliment which was also paid to the author for the present essay by the Board of Trade of Geneva. This essay was originally written in French, but has been specially re-written for our columns, and it will appear in an improved and enlarged form. Numerous woodcuts, executed from the author's own drawings, will accompany the text.]

Introduction.

The construction of a good watch is undoubtedly one of the most complicated problems in the whole range of practical mechanics. Not only the small dimensions, but also the absolute necessity of confining the whole mechanism to a space of a certain shape, which must not be transgressed nor altered, together with the claims to mechanical perfection and exterior elegance, are difficulties which may not be encountered in the same degree by any other branch of engineering.

The ingenuity and skill of the practical horologist have nevertheless contrived many different constructions of watch movements; and especially in Switzerland, that old centre of watch manufacturing, there exists an incredible variety of designs, more or less happily adapted to their purpose. In reviewing so many different expressions of the same fundamental idea, the attentive observer will not fail to arrive at the conclusion that a great part of these different patterns have been invented in order to produce something novel and original, or to suit some taste or fashion. Some of them, indeed, make an impression as though a watch were a fancy article and not a scientific instrument.

This was certainly one of the chief motives which caused the Board of Trade of Geneva to open a competition for the study of a simple and normal movement. Being impressed with the usefulness of a clear treatment of this matter, and having become practically acquainted with the manufacturing systems of Switzerland, England, France and Germany, I resolved to enter into this competition; and I had the satisfaction to see that my reflections were favourably judged and approved by the jurors.

Watch manufacturing has of later years undergone considerable changes, and in the United States it is carried on in an altogether different way from what it is anywhere else.

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The excessive cost of skilled hand labour has led to an extended employment of mechanical appliances, and it is really gratifying to learn what amount of skill and sagacity has been developed in the construction of automatic and self-measuring little machines.

The system of perfect identity of the parts of the movement is certainly very commendable, and affords great facilities in manufacturing large quantities. It has already been adopted in Paris and Geneva, and the possibility of maintaining this identity within certain limits is no longer doubtful. Still it seems to me that the system ought not to be extended to the manufacturing of the escapement, which, in carefully made watches, ought always to be treated as an individual, especially the lever escapement. The horizontal escapement, on the contrary, would admit much better of identical treatment.

Watch manufacturing in Switzerland is organised in a very different way from what it is in the United States. In Switzerland a number of comparatively small establishments get up the movements, that is, the frames, wheels and pinions, barrels and clickwork. The watch manufacturer orders or buys them, and gets the casing, motion work, escapement and finishing done.

The leading principles in the construction of the movements are better not inquired into, as they seem to be governed by the taste of the customers rather than by mechanical science. This organisation gives rise to great irregularities and inconveniences in manufacturing, which has caused several houses of importance, especially in Geneva, to create a complete manufacture of movements for their own wants in certain localities, much in the same way as it is now done in the watch factories of the United States.

The English way of manufacturing presents nearly the same general feature, so far as the movements are concerned; but their completion is more dispersed over the country; at almost every place there are watchmakers who, besides attending to the repairing business, do more or less in the manufacturing line, so that comparatively few manufacturers in the Swiss style exist. This system has the decided advantage of fostering that taste for new work, and of affording facilities to those desiring to carry out any scheme of a new escapement. On the other hand it puts the manufacturer of movements rather out of the reach of his customers' influence and wishes, and this, together with other circumstances, must account for many astonishing imperfections in the getting up of movements. Many manufacturers are aware of them, but unable to force their views on the movement makers. During the last fifteen years several of them have begun to work on the system of identity, but I have not heard anything as to their success.

The English, Swiss, and French manufacturers of movements suffer in common from the want of a generally acknowledged working standard, and of adequate measuring instruments. In France and Switzerland the horological population holds with uncommon tenacity to the antiquated measuring system based upon the "Pied de roi" (the king's foot), though neither of these countries has a king. This system, totally at variance with the political institutions, with the monetary and measuring systems of these countries, and with the daily social practice, is entirely impracticable for calculation and intercomparison, and not very appropriate to the dimensions of watchwork; it ought to be abolished and replaced by the metric system. If I am correctly informed, this latter has been introduced in the factories of Geneva.

The English manufacturers work upon the unit of the English inch — still more unfit for watchwork than the Paris ligne; but the majority of special parts are classified by their makers in arbitrary sizes, without any reliable standard, and without any guarantee that a certain size of one maker is uniform with the equally numbered size of another maker. The disadvantage of such a state of things could not fail to strike the observation of the thinking horologists there, and, in fact, the inconveniences arising from it are rendered much more perceptible from the fact that watch manufacturing is spread all over the United Kingdom, while the movements are only made in the Lancashire district. Thus, the London manufacturer has to get his movements—wheels, pinions, hands, etc.—from a distance of at least 150 miles, and it is easy to understand that it requires a good deal of practice to do this without frequent mistakes, owing to the want of a generally acknowledged standard of measuring.

This caused the British Horological Institute to issue a circular in 1861, asking for information about a good and practical universal measuring system; and it was expressly stated that the suggestions to be made should in no way be bound to the actual English standard of measuring. I forwarded a detailed description of the method and instruments in use here in Glashutte for employing the metric system. This was published two years afterwards, and warmly recommended by the special committee appointed to deal with the gauge and measuring question. No other communication was published afterwards, except an eccentric gauge, which, by its nature, admitted no connection with any standard, and I therefore concluded that no other suggestion had been submitted. Nevertheless, the opinion of the committee has found no followers, and English watchwork is, up to the present day, measured by inches and their fractions.

In my "Treatise on the Detached Lever Escapement," I expressed my opinions on the matter in detail, and tried to prove the perfect applicability of the metric system to watchwork, in the calculation of its dimensions and proportions.

It is very much to be regretted that the watch factories of the United States had not at once introduced the metric measurement, which affords such great facilities; it might have been very easily done, because everything had to be created anew, and because these factories form, as it were, each a world for itself.

The Swiss watch manufacturers have complicated their task in a very unnecessary way by creating a great variety of sizes of movements. Their regular sizes begin at 10 lignes, and go up to 21 lignes, thus giving twelve sizes. But a too great readiness to meet the most minute exactions of their customers, has led them so far as to have even sizes by half lignes. The English watches have also about seven regular sizes. Even this I think too many, and a gradation by one ligne (about 2·5 mill.) is finer than required to meet even the most pronounced taste. If six sizes were adopted, differing by three mill. from each other, the mannfacturing would be very much simplified. The sizes then would be 31, 34, 37, 40, 43, and 46 mill., and would embrace the whole range from 13 to 21 lignes. Watches smaller than 13 lignes, or 31 mill. ought not to be made.

To these introductory remarks I will merely add, that for establishing the proportion of the parts of movements, I think it the best way to find their relation to the diameter of the pillar-plate in as simple fractions as it can be done.

According to my opinion, the question: *What caliper is the best for the cheap production of a simple but mechanically perfect and sound watch movement?* can best be answered by studying the designs already employed as to their relative merits, and by choosing the most commendable of them; or, if the actual methods do not seem convenient, by creating a new one.

(*To be continued.*)

PRIZE ESSAY ON WATCH TOOLS.

THE French Society for the encouragement of national industries offers a prize of 1,000 francs for the best essay on the tools employed in America in the manufacture of watches.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. XI.

(*Continued from page* 101.)

THE Leclanché battery, introduced in our last article, consists of an exterior glass vase, of cubic form, so that the various vases of a battery can be brought face to face and thus occupy the least possible space. The head of the vase is, however, cylindrical, and has a lip to facilitate the pouring out of the liquid and to receive a zinc rod. The zinc may be amalgamated. The latter reaches to the bottom of the glass vase, and its upper end carries a conducting wire covered with gutta percha, the extremities excepted. The porous cell, in which the carbon plate is deposited and fixed, is placed in the centre of the glass vase, and its binding wire soldered to the carbon by means of lead run between them, The vacant space between the porous vase and the carbon is filled up by a mixture of equal quantities of charcoal and binoxyde of manganese, both finely pulverised; and as this part of the apparatus has to serve for an almost indefinite period, a resinous compound is poured on the mixture in the porous cell to completely cover the powder, and to intimately connect the cell and the carbon: a hole of six or seven mill. is left only to effect a more easy introduction of the liquid to the pile.

This pile is charged with a simple solution of—

Water	1,000 grammes.
Sal Ammoniac	80 „

If a larger quantity of sal ammoniac is employed, the double chloride of zinc and ammonia, formed by the action of the pile, will crystallize on the rod and interrupt the current.

It suffices to add a little water every fortnight or month to the elements, to replace the evaporated water.

If, in spite of this precaution, the pile does not supply the necessary current, or if the sal ammoniac is spent, or the zinc rods become covered, the battery must be taken to pieces, and the zincs washed and scraped with an old knife. This properly done, the elements need only to be re-connected and the vases filled with the sal ammoniac solution.

Watt's Battery.—In a stoneware jar, holding about four gallons, place a cylinder of thin sheet copper, dipping into water acidulated with 2 lbs. of sulphuric acid and 1 oz. of nitric acid. A solid zinc cylinder is put into the porous cell, which is filled with a concentrated solution of common salt, to which a few drops of hydrochloric acid have been added.

An intense current for brass and hard deposits will be obtained by joining alternately the zinc of one element to the copper or carbon of the next one. For silver-plating a smooth and not too hard deposit is desired, the current should be feeble in intensity, but considerable in quantity, and may be obtained by connecting together all the zincs on the one side, and all the coppers or carbons on the other.

The porous cells are absolutely necessary in batteries working with two exciting solutions, like the Bunsen battery; but the trouble arising from the clogging of the pores of the cell, and from the difficulty of preventing the diffusion between the two liquids of the porous cell and of the jar, the specific gravity of which is constantly varying, makes it desirable that the cell should be dispensed with in batteries worked with but one exciting fluid.

Callaud Battery.—The Callaud Battery is a modification of that of Daniell, doing away with the porous cell. A jar is filled with water acidulated with sulphuric acid, only for starting the solution of the zinc, as the sulphuric acid will be furnished afterwards by the sulphate of copper. The zinc and copper plates are both placed horizontally in the jar—the zinc in the upper part, and the copper lying on the bottom. To start this battery, throw into the jar a few crystals of sulphate of copper. These go to the bottom, dissolve, and form a saturated solution around the negative plate of copper. The electrode or conducting wire from the copper plate may be made to pass through a glass tube reaching down to the bottom of the jar, and large enough to contain a supply of crystals of sulphate of copper necessary to keep a saturated solution in the lower part of the cell. This avoids disturbing the upper part of the liquid in which the zinc dips, and its mixture with the solution of sulphate of copper. The deposits from the zinc and other impurities are prevented from falling upon the copper plate, and thus interfering with the current, by covering the copper plate with a layer of clean quartz sand, which serves also as an obstacle to the effusion upward of the sulphate of copper, because the interstices between the grains act as a series of narrow tubes, but the force of the cement diminishes by reason of the increased resistance.

Mr. J. W. Urquhart, in his recently published book on electro-plating, describes a lately introduced battery—said to be an excellent generator of electricity. It is called

Fuller's Battery.—Our authority states that it is also well fitted for gilding, and gives even less trouble than the Daniell, while its strength is greater. It is not, however, suited to the plating of large surfaces. The containing pots (exterior vessels) are of the same material as those of the Daniell, the Grove, or the Bunsen. The zinc is in the form of a rod, flattened out at the lower end, and coated with sealing-wax varnish except at this end. A layer of mercury covers the lower end at the porous cell bottom, and the cell is then filled up with water only. The outer cell contains only a carbon plate, with a solution of potash bichromate, strongly mixed with sulphuric acid—one to eight. The circuit should be closed after setting up for about six hours, when the action will be much stronger than at first.

(*To be continued.*)

WATCHMAKERS', JEWELLERS', AND SILVERSMITHS' TRADE SOCIETY.

WE continue to receive letters on the above subject, which, with but few exceptions, testify the deepest interest. They are, however, mostly only repetitions and corroborations of statements made by previous correspondents, so that we need not again fill our columns with them. We do not wish to discourage those who have something to say on the matter from writing; on the contrary, any original suggestion or additional evidence will be gratefully received and published.

We are now preparing a list of the names of gentlemen who have expressed their willingness to assist the movement, and we again respectfully invite the co-operation of all our readers. As soon as we have a sufficient number of supporters we shall take the first steps towards giving the movement practical form.

Hardening Small Tools.—It is said that the engravers and watchmakers of Germany harden their tools in sealing wax. The tool is heated to whiteness, and plunged into the wax, withdrawn after an instant and plunged in again, the process being repeated until the steel is too cold to enter the wax. The steel is said to become, after this process, almost as hard as the diamond, and when touched with a little oil or turpentine the tools are excellent for engraving, and also for piercing the hardest metals.

GOLDSMITHS' HALL, LONDON.

Technical Education, 1880. Ninth Competition.

With a view to the encouragement of technical education in the design and execution of works in the precious metals, the Goldsmiths' Company of London have settled the following programme of prizes for the current year :—

£40.—A prize of £40 for the best design of a silver plateau for the dinner table, to hold fruit or flowers, no part to exceed 12 inches in height, the cost of which, when manufactured, would not exceed £350.

£40.—A prize of £40 for the best design of a silver candelabrum, to carry seven lights, not to exceed 30 inches in height, the cost of which, when manufactured, would not exceed £200.

£30.—A prize of £30 for the best design of a silver candlestick, with branches to carry 5 lights, not to exceed 24 inches in height, the cost of which, when manufactured, would not exceed £80.

£20.—A prize of £20 for the best design of a silver dessert stand, for fruit or flowers, not to exceed 12 inches in height, the cost of which, when manufactured, would not exceed £30.

£20.—A prize of £20 for the best workmanship in a finished piece, answering to these last-mentioned particulars.

£20.—A prize of £20 for the best design of a coffee and tea service (of 4 pieces), the cost of which, when manufactured, would not exceed £60.

£20.—A prize of £20 for the best workmanship in a finished service, answering to these last-mentioned particulars.

£20.—£20.—A prize of £20 for the best design of a silver tea kettle, the cost of which, when finished, would not exceed £60; and a prize of £20 for the best workmanship in a finished piece, answering to these last-mentioned particulars.

£20.—£20.—A prize of £20 for the best design of an ink stand, the cost of which, when finished, would not exceed £50; and a prize of £20 for the best workmanship in a finished piece, answering to these last-mentioned particulars.

£20.—A prize of £20 for the best design of a large silver salt cellar, the cost of a pair of which, when manufactured, would not exceed £25.

£20.—A prize of £20 for the best workmanship in a finished piece, answering to these last-mentioned particulars.

£10.—A prize of £10 for the best design of a salt cellar, of which the cost of a pair would not exceed £6.

£10.—A prize of £10 for the best workmanship in a finished piece, answering to these last-mentioned particulars.

£15.—A prize of £15 for the best design of a dessert knife, fork, and spoon, of which the cost, when manufactured, would not exceed £6 for the three pieces.

£15.—A prize of £15 for the best workmanship in finished pieces answering to these last-mentioned particulars.

£50.—A prize of £50 for the best model in plaster, finished. ready for casting, of a group—"Man and horse"—the extreme height of the man not to exceed 12 inches.

£35.—A prize of £35 for the best specimen of human figures, executed in *Repoussé* work, to form the back of a lady's hand mirror (oval), which must be accompanied by a sketch showing the entire design of the mirror. The subject to be taken from the "Midsummer Night's Dream."

£15.—A prize of £15 for the best specimen of flat chasing of a lady's glove or handkerchief box.

£10.—A prize of £10 for the best specimen of engraving.

The cost of the manufactured articles is not intended to include the expense of designs, of models, patterns, or dies.

Everything offered for competition must have been made within the present year and by a British subject, and the prizes will only be given to the actual executants.

All designs must be drawn, and all models made, to exact size, and be accompanied by an approximate estimate of weight and cost.

All necessary sections must be given.

Any partial gilding must be shown on each design or model.

An indication must be given on each drawing, showing which parts are to be hammered, which chased, and which cast and chased.

Originality shall be necessary to obtain either of the prizes for design, and no copy shall be the subject of a prize.

The prizes will be awarded in the month of December next, and objects of art and workmanship must be sent by the competitors to Goldsmiths' Hall, addressed to the care of the clerk, in the week ending the 27th of November, between the hours of 11 o'clock a.m. and 4 o'clock p.m.

Each object shall have a monogram or other private mark attached to it, a counterpart of such mark being put on the outside of a sealed envelope addressed to the clerk, and containing within it the name and address of the competitor, which envelope will not be opened until the prizes shall have been awarded.

The objects sent in competition for prizes shall be left until the 1st of March, for exhibition by the Goldsmiths' Company, if the Company shall think proper to cause them to be exhibited.

The Company reserve to themselves the right to withhold the prizes for the several objects before mentioned, or either of them, whenever they shall be of opinion that no object of sufficient merit shall have been submitted to them.

The Company have also resolved that a travelling scholarship of £100 may be awarded by the Wardens to a student who has shown exceptional talent, and who shall have obtained prizes for design or modelling in three competitions, in order to enable him to study art in the precious metals on the Continent of Europe.

Walter Prideaux,
Clerk of the Goldsmiths' Company.

Goldsmiths' Hall,
January, 1880.

ELECTRIC TIME-BALL FOR INDIA.

The Indian Government having decided upon erecting an electric time-ball and gun-firing apparatus at Fort William, Calcutta, the same has been designed by Mr. S. Alfred Varley, who has had special experience in this class of electrical mechanism. The apparatus consists, in the first place, of a clock, which will be placed at the observatory, together with a commutator for sending electric currents to lock and to release the time-ball and to actuate the gun-firing apparatus, and which also records at the observatory the correct operation of the same. In the next place, there is the time-ball and its locking apparatus, which will be placed at Fort William, with the gun-firing mechanism in its vicinity, the two being connected by electric wires with the commutator and clock at the observatory, which may be any distance away. The time-ball is 5 ft. 6in. in diameter, and weighs, with its attachment, about 5 cwt. It is wound up a mast by means of a rack and pinion, and when released falls through a space of 10 ft. Attached to the ball, and beneath it, is a rod having a piston at its lower end. After the ball has fallen 4 ft. this piston enters a pneumatic cylinder, in which it meets with resistance from the contained air. The air forms a cushion, and allows the ball to finish its descent without any shock or concussion being experienced, this result being assisted by a pressure-relieving valve in connection with the pneumatic cylinder. The ball, as regards its size and the space through which it falls, is similar to those which were erected at Charing-cross and Liverpool in 1853 and 1854 at the suggestion of the Astronomer-Royal, to whom we are indebted for the idea of utilising electricity for discharging time-balls. Improvements in detail have, however in the present instance been introduced by Mr. Varley, both in relieving the air pressure and in insuring greater rapidity and certainty of action by means of special mechanical and electrical arrangements. A very important point in connection with time-ball apparatus is that their working should be absolutely reliable. In order therefore, that it may be known at the observatory, whence the time emanates, whether the signal arparatus has acted or not, the time-ball is made to send back a return signal at the moment of its release. Another point of importance is that there shall be no appreciable loss of time in the falling of the ball by reason of the time occupied by the action of the disengaging or releasing apparatus. In the Liverpool time-ball the loss of time amounted to 3-10ths of a second, but in the present apparatus the loss due to this cause is found to be only 1-20th of a second. This reduction is accomplished by the improved construction of the time-ball lock, which consists of a series of levers, the lightest of which is started by the electric current. As the ball is wound up a few minutes before the time signal is sent, there is the danger of its being released by a false current before the proper current is sent. A false current may be produced by the time wire being accidentally brought in contact with another circuit, or from meteorological causes. The time-ball lock in this particular case is therefore constructed on the polarized system introduced by Mr. Varley—that is, it works with opposite electrical currents, one current locking it, and an opposite current releasing it. A locking current is, therefore, sent a few minutes before the discharging current, and the apparatus remains firmly locked by an electrical current more powerful than any accidental current is likely to be until the very moment of discharge. The time signal will be sent at 1 p.m. daily, when the release of the electric lock will divide the electrical circuit, and will send back a return signal just after the ball has commenced to fall. This will be received at the observatory, where it will be known that the time signal has been given. Should the electric lock at the time-ball hang fire, this will at once be detected at the observatory. The gun is fired by means of an induction coil and a local battery, set in action by the time current. In connection with this apparatus there is also an electric lock, which prevents the gun being placed in circuit until it is protected from any false current. The first time-ball apparatus constructed on the polarized system was designed by Mr. Varley, at the instance of the late Sir Thomas Maclear, Astronomer-Royal at the Cape of Good Hope, for the Port Elizabeth time-ball which was erected in 1865, and gives time to the shipping in Algoa Bay. This ball is discharged from the Cape Town Observatory, which is 500 miles distant, and the return signal recording the falling of the ball was stated by Sir Thomas Maclear to have been received 1-15th of a second after the time current was sent. The apparatus for India has been manufactured at the works of Messrs. Siebe and Gorman, Mason-street, Westminster-bridge-road, where its working was lately inspected by General Hyde and Mr. W. F. Batho, C.E., on behalf of the Indian Government, and by whom it has been duly approved, and will be forthwith sent to Calcutta. We may add that a set of time-ball apparatus similar to that just described is in course of construction for another Indian station.

Hawkers of Watches Outdone.—The watchmakers of the canton of Thurgan (Switzerland) handed a petition to their cantonal council, setting forth the injurious effects of the hawking system as applied to watches, etc. The council took the matter into consideration, and the result is that watches have been struck off the list of articles included in the hawking laws.

QUERIES AND ANSWERS.

A Subscriber.—I use standard gold for making 18 and 15 carat gold, using fine silver and copper, also charcoal and sal ammoniac as a flue; but when the qualities are passed through the rolling mill they sometimes crack, and when submitted to the colouring pot come out full of small holes. I should therefore feel greatly obliged if any reader would help me over this difficulty.

To Vortex and J. S. L.—The best and simplest lathe suitable for your correspondents is the following:—

Turn, with lathe head and three plates to cement on, chuck with eight steel screws, attachment for drilling with lever and drill plate, attachment for cutting, head with six cutters.

Cutting attachment.—Slide the head with a cutter upon the spindle of the drilling attachment and press the wire you want to cut, supplied with a carrier, against the back centre, or screw it into the chuck, file the wire taper and press the cutter against it by means of the lever. In this manner you can make screws, pivots, pillars, etc., very easy and quickly.

Drilling attachment works very rapidly and accurately, and may be regarded as a horizontal drilling tool. Small drills are put into the drill head, larger ones into the chuck with eight screws; both, drill head and chuck, to be screwed upon the left worm of the lathe-head's spindle. The chuck with eight screws will besides prove advantageous for such articles as cannot be turned between the centres. This tool is extremely useful, of first-class make, and I am glad to recommend it. I bought mine of Messrs. Swinden and Sons, of Temple Street, Birmingham, and only paid 42s. for it complete.—*Hints to Repairers.*

Salesman.—Could you or any well-informed correspondent give me the address of a wholesale dealer in vulcanite and bog-oak goods, such as brooches, necklets, etc.? A reply through this Journal will oblige.

TWO MORE CLAIMANTS FOR THE ARTIFICIAL PRODUCTION OF DIAMONDS.

Mr. A. H. ALLEN, analytical chemist, while speaking on the artificial production of precious stones, before the Sheffield Literary and Philosophical Society, expressed a confident opinion that the artificial production of diamonds had been discovered by Dr. Marsden, a former pupil of his. Dr. Marsden, he said, had worked in a very different way from Mr. Mactear, of Glasgow, and from the results communicated to him he had no doubt Dr. Marsden would be able to produce diamonds artificially.

Glasgow, in spite of the failure of Mr. Mactear's diamonds, is, however, not going to be so easily disposed of, and another celebrated chemist of that city, Mr. Ballantine Hannay pretends to have accomplished what the former gentleman failed to do. Mr. Hannay has submitted to Professor Story-Maskelyne "small crystallised particles," made from carbon in his laboratory, "presenting exactly the appearance of fragments of a broken diamond." At sight these tiny products, it is said, could almost be declared the real thing. They had, moreover, the lustre, the lamellar structure, the cleavage, the refractive power of the diamond; they were nearly inert in polarised light; they gave the proper angles to the goniometer; and they readily scratched deep grooves upon the surface of a polished sapphire, which nothing but the true diamond can do. Finally, they glowed and disappeared as the diamond does when ignited on a foil of platinum, and the upshot of this examination is that Professor Story-Maskelyne asserts them, "without any doubt whatever," to be veritable brilliants.

HINTS TO REPAIRERS.

(*Continued from page* 103.)

THE subject of drills presents claims for consideration as endless and various as any one in the mechanical arts. The best form and proportion, and the best mode of construction of these tools, are still unsettled questions—their various uses requiring almost infinite diversity. One of these requirements has scarcely ever been discussed, or even noticed. In drills for working hardened steel we must have every possible advantage. None but the very best quality of steel will serve, and the most careful manipulation is equally imperative; for let it here be understood that the degree of hardness that can be imparted to a piece of steel greatly depends on the manner of working it, as well as on the process of hardening. Density, or hardness, strength and toughness, are the points aimed at, and these properties are not incompatible, as is often considered.

Steel is simply carbonised iron. In cast iron we have one extreme of this compound, and in wrought iron the other. Of course both have impurities. In the one we have the coarse, bright, angular crystals, with considerable hardness; while the other is soft, tough, and fibrous. Some grades of steel show, under the microscope, the grain coarse and crystalline, or sometimes almost globular, like fine shot adhering together. Such steel may be comparatively hard, but it lacks strength and toughness. The best tool steel shows a very fine crystalline, silky grain. Of course these qualities are important for many other tools besides these special drills, but for these the need is absolute; and now comes the enquiry, What form and proportion must we give them to be most effective?

Having selected the steel, it should be carefully forged at a low red heat, and finished with light blows at a black heat, so as to condense it as much as possible without destroying the grain or cracking the steel. When forging the cutting end of the drill it should be left large enough, so that in flattening for a drill, while it is hardly visibly red, or just at a black heat, the thickness of this flat part shall be one-half or two-thirds of the intended diameter of the finished drill; and on no account should it be hammered edgewise, as this opens the pores of the steel, breaks up the grain, and greatly weakens it. The drill is now to be finished to size and shape by turning or filing, forming the cutting angles at the end at about 130°, also thinning the point down to about one-sixth of the whole diameter, and leaving on the back just enough to give a projecting edge.

The best angle for the cutting end of a *hard* drill is about 130°, and 90° is as pointed, as is often desirable in drills for common use. But the kinds of work, the materials used, and the objects aimed at, are so various that only a varying rule, so to speak, can be given, which may be stated thus: *The cutting angles should be carefully shaped so as to wear equally at the point and corners*, else, if the drill is too pointed, this grows dull before the corners; and if the angle is too obtuse the corners fail first. Much care should also be used to sharpen the drill equally, so that each edge is the same, and the point exactly central. If one edge is sharper than the other, there is a liability to run off from the central point. Twist drills, as they are found in the market, have the spiral groove extending to the point. These operate well in steel or iron, but for brass or other soft or thin sheet metal the front edge should be ground flat and lengthwise of the drill for a short distance (at least the depth of the chip or cut), otherwise the tendency is to run in on the twist like a screw. The cutting edge should not be too thin, as it would be more likely to "chatter" (not making a smooth hole), and also more apt to break. This is especially true in very hard drills, for under such heavy pressure as is required in drilling hard steel, the least chatter would be fatal to the edge; and to obviate this, as well as to give strength, it should have greater thickness than is useful in softer drills. Hard drills should also be finished before hardening, as the surface can be made, by the use of the following powder, slightly harder than the internal part, thus adding hardness to greater strength and toughness:

6 oz. Prussiate Potass,
6 oz. Bichromate Potass,
22 oz. Common Salt,

all finely pulverised and thoroughly mixed.

Heat the drill to a dull red, and cover it with a thick coat of the above powder, which, when again heated in the fire, melts, runs over the steel, and protects it from burning; when brought to a cherry red, plunge into cold water, and it is ready for use.

The reader will say, "What has all this to do with pivot drills?" Very much; as I have found by nearly thirty years' experience. Suppose we have a broken staff of a fine nicely adjusted watch, and we find the balance uninjured; now, if a new pivot can be inserted without disturbing the balance, we may perhaps save re-adjusting, or in part at least. The temper of the staff may be as hard as if drawn down to a *dark* yellow or reddish colour. Now to drill this requires a good tool, and some care and patience, as such a drill, on a small scale, as described above for hardened steel, is well adapted to the work. To make these fine drills, file down the wire (or narrow slips cut from thick pieces of main springs of fine wire steel), a little tapering, to nearly the proper size, and flatten the end till it cracks open; then file back just enough to cut off the cracked part. This ensures the utmost condensation possible to the metal. Now file up to size and shape, so that when finished the thickness will be about one-half the diameter. Have the lamp flame small, so as not to overheat, and when red thrust into a piece of tallow held as close to the lamp as possible, so as not to cool the drill in the tallow instead of the air. If the drill is carefully made and hardened, it can be used without drawing the temper, and should be as short as possible to allow the needed pressure in drilling, and used *without oil.* With slow speed and strong pressure a drill made as above will enter any staff or pinion that is safe to use. Hollow joint makes the best handle, and fasten in the drill with shellac.

A strong solution of the hardening powder, in soft water, will give a harder temper than tallow. By using the powder fine steel as well as iron can be case-hardened, if it is not too hot, when plunged into cold water. A lower heat that would not harden at all without the powder, will *case-harden* when the higher temperature would *harden through.* It will need a few trials to properly adjust the heat so as to surface-harden, and not harden through.

(*To be continued.*)

HER MAJESTY'S STATE CROWN.

THE Imperial State Crown of Queen Victoria, which her Majesty wore at the opening of Parliament, on Thursday the 5th ult., was made in 1838, with jewels taken from old crowns, and others furnished by command of her Majesty. It consists of diamonds, pearls, rubies, sapphires, and emeralds, set in silver and gold; it has a crimson velvet cap with ermine border, and it is lined with white silk. Its gross weight is 39 oz. 5 dwt. troy. The lower part of the band, above the ermine border, consists of a row of 129 pearls, and the upper part of the band of a row of 112 pearls, between which, in front of the crown, is a large sapphire (partly drilled) purchased for the crown by his Majesty King George IV. At the back is a sapphire of smaller size, and six other sapphires (three on each side), between which are eight emeralds. Above and below the seven sapphires are 14 diamonds, and around the eight emeralds 128 diamonds. Between the emeralds and the sapphires are 16 trefoil ornaments, containing 160 diamonds. Above the band are eight sapphires surmounted by eight diamonds, between which are eight festoons consisting of 148 diamonds. In the front of the crown, and in the centre of a diamond Maltese cross, is the famous ruby said to have been given to Edward Prince of Wales, son of Edward the Third, called the Black Prince, by Don Pedro, King of Castile, after the battle of Najera, near Vittoria, A.D. 1367. This ruby was worn in the helmet of Henry the Fifth at the Battle of Agincourt, A.D. 1415. It is pierced quite through, after the Eastern custom, the upper part of the piercing being filled up by a small ruby. Around this ruby, in order to form the cross, are 75 brilliant diamonds. Three other Maltese crosses, forming the two sides and back of the crown, have emerald centres, and contain respectively 132, 124, and 130 brilliant diamonds. Between the four Maltese crosses are four ornaments in the form of the French fleur-de-lys, with four rubies in the centre, and surrounded by rose diamonds, containing respectively 85, 86, and 87 rose diamonds. From the Maltese crosses issue four imperial arches composed of oak leaves and acorns; the leaves contain 728 rose, table, and brilliant diamonds; 32 pearls form the acorns, set in cups containing 54 rose diamonds and one table diamond. The total number of diamonds in the arches and acorns is 108 brilliant, 116 table, and 559 rose diamonds. From the upper part of the arches are suspended four large pendant pear-shaped pearls with rose diamond caps, containing twelve rose diamonds, and stems containing 24 very small rose diamonds. Above the arch stands the mound, containing in the lower hemisphere 304 brilliants, and in the upper 224 brilliants, the zone and arc being composed of 33 rose diamonds. The cross on the summit has a rose-cut sapphire in the centre, surrounded by four large brilliants, and 106 smaller brilliants.

EXHIBITION OF GOLD AND SILVER WORK, JEWELLERY, PRECIOUS STONES, CLOCKWORK, AND OF THE TOOLS USED IN THEIR MANUFACTURE,

To be held at Groningen (Kingdom of the Netherlands), in July, 1880, on occasion of the General Meeting of the Dutch Society for Promotion of Industry.

The committee of management of the exhibition above mentioned, appointed by the Groningen department of the Dutch Society for promotion of industry, invites all manufacturers of gold and silver objects, jewellery, precious stones, clocks and watches, and of the tools used in their manufacture, to exhibit the products of their artistic labour, and to compete for the medals that will be awarded.

The exhibition will be held from the 13th July to the 1st August, in the rooms of the university, and will be divided into four classes, viz:—

A. Objects of gold and silver workmanship.
B. Jewellery and precious stones.
C. Instruments for time keeping.
D. Instruments used in the manufacture of the above mentioned.

Space is provided free of charge, and in each of the four classes will be awarded gold, silver, and bronze medals and honourable mentions.

The exhibitors must communicate to the committee before the 15th May, 1880, post-paid, their wish to exhibit, the price of the objects if offered for sale, and return the demand for admission duly filled in.

The exhibits must be sent to the committee before the 1st July, 1880, carriage-paid.

If the objects should be sold by the committee, the exhibitor can draw for the amount on the treasurer of the exhibition, immediately after the close of the exhibition, less an abatement of 5 per cent. The objects sold are to be delivered to the purchasers after the close of the exhibition.

No objects may be offered for sale or admitted to competition but those exhibited by the makers, and the committee reserves the right to refuse the objects which they judge unsuitable.

The exhibited articles will be guarded with the utmost care. The committee however will not be responsible for any damage or loss.

If desired, the committee will effect the fire insurance, at the cost of the exhibitors, to the amount fixed in the demand for admission.

After the close of the exhibition the articles unsold will be returned to the exhibitors; the costs falling on returning the articles are for the account of the exhibitors. The committee will request the railway companies to lower their charges.

Owners of antique gold, silver, and jewelled objects or clockwork are warmly invited to send these articles for embellishment of the exhibition.

TABLE FOR APPROXIMATELY CONVERTING THE ENGLISH DECIMAL OUNCE WITH THE CONTINENTAL GRAM WEIGHTS.

1 oz.	= 31gr.	10cgr.	31gr. 10cgr.	= 1 oz.	90 centigram.	= ·029 oz.
·9	,, ,, 27 ,,	99 ,,	31 gram	,, ·997 ,,	80 ,,	,, ·026 ,,
·8	,, ,, 24 ,,	88 ,,	30 ,,	,, ·965 ,,	70 ,,	,, ·023 ,,
·7	,, ,, 21 ,,	77 ,,	29 ,,	,, ·932 ,,	60 ,,	,, ·020 ,,
·6	,, ,, 18 ,,	66 ,,	28 ,,	,, ·900 ,,	50 ,,	,, ·016 ,,
·5	,, ,, 15 ,,	55 ,,	27 ,,	,, ·868 ,,	40 ,,	,, ·013 ,,
·4	,, ,, 12 ,,	44 ,,	26 ,,	,, ·836 ,,	30 ,,	,, ·010 ,,
·3	,, ,, 9 ,,	33 ,,	25 ,,	,, ·805 ,,	20 ,,	,, ·007 ,,
·2	,, ,, 6 ,,	22 ,,	24 ,,	,, ·772 ,,	19 ,,	,, ·006 ,,
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·0003	,, ,, 0 ,,	1 ,,	3 ,,	,, ·096 ,,		
			2 ,,	,, ·064 ,,		
			1 ,,	,, ·032 ,,		

Examples.

Convert ·476 ounce into grams.

·4 oz.=12 gr. 44 centigr.
·07 ,, ,, 2 ,, 17 ,,
·006 ,, ,, 0 ,, 18 ,,

·476 oz.=14 gr. 79 centigr.

Convert 26 gr. 30 centigr. into decimal ounce.

26 gr. = ·836 oz.
0 ,, 30 cgr. ,, ·010 ,,

26 gr. 30 cgr. = ·846 oz.

H. Bush, Hull.

THE SILVER TRADE.

We are glad to find, from the speech of Mr. J. E. Bingham at the Chamber of Commerce meeting on Monday last, that the anomalies of our present laws and customs as to trade in silver plate, are at length entering into the manufacturers' souls. We, and others, have hammered at this matter for a good many years, and though we cannot congratulate the Chamber of Commerce on having shown that it possesses an adequate grasp of the subject, it is at any rate satisfactory to find that body discussing—even though impatiently and perfunctorily—some of the regulations under which the English silver trade is a declining industry. These regulations are so indefensible that the more they are brought under notice, the better for all concerned; and though it might have given to the public a higher appreciation of the Chamber of Commerce if its members had shown some acquaintance with the evidence given in 1878, before the House of Commons' Select Committee on Gold and Silver Hall-Marking, it is a step in advance to get a discussion on any branch of the subject. It was the provincial manufacturers' grievance against the local Assay Office which chiefly occupied the attention of the Chamber the other day. At present, Mr. Bingham's complaint is limited to the personal or local inconvenience which he, as a manufacturer of silver ware, experiences through the Sheffield Assay Office charging higher fees than Goldsmiths' Hall, insisting on a higher standard, and causing delay by being open for work only two days a week. We are not without hope that as some, at least, of our manufacturers have begun to express, in public, the difficulties under which they thus suffer, they will be led on to take broad views of the whole question, and to see that these provincial disabilities are but parts of a wide system that can only be improved by sweeping remedies. For it is curious to find clear-sighted business men troubling themselves about the petty details of the Assay Offices—whose operations, however burdensome, they have borne with considerable complacency for a great many years—when there lies at the root of the entire matter, calling for immediate and vigorous measures, the distinct decay of the whole silver industry. Under a mischievous fiscal policy the English silver trade is becoming more and more decrepit. The protection to which it so fondly and so shortsightedly clings, is its bane. Like a timid valetudinarian, crouching over the fire, and shrinking from the vigorous buffetings of health-giving breezes, it is perishing through a mischievous system of effeminate coddling. Its existence as an active, growing art-life has already gone; its existence as a remunerative industry is rapidly going. Artistically, its utmost achievements consist in a servile copying or an ignominious repetition of a debased past; commercially its extent is a constantly diminishing quantity. In proof of the first assertion, we have only to refer to the silver work of America and of France, that has so utterly eclipsed the efforts of English competitors at International Exhibitions. In substantiation of the second, the figures which we publish in another column to-day bear emphatic witness. In 1855 duty was paid on 994,360 oz. of silver; in 1875 duty was paid on only 880,493 oz. In 1859 the duty paid was on 801,680 oz.; in 1879 this had become reduced, through a constantly decreasing series, to 740,239 oz. Still more striking are the figures showing the persistent falling off in "drawbacks"—which indicate the exports of silver. Suffice it here to say that whereas 156,440 oz. were exported in 1855, in 1879 there were exported only 85,121 oz. The double inference is an uncomfortable one, but it cannot be avoided. The duty on silver, with all its attendant impediments upon the free development of artistic manufacture, is strangling an old home trade, and has so encouraged lethargy, so stamped out enterprise that we are losing irretrievably our foreign markets. Complacently dwelling under the fatal blight of laws which preclude the sale in this country of foreign-made silver, our manufacturers have had none of the stimulus of competition—and they awake to find the Americans supplying themselves with goods with which, in artistic beauty and even manipulative finish, our own will not bear comparison. At home, notwithstanding the increased purchasing power of the country, the sale of silver goods steadily declines. Seduced by the miserable rebate they have had as the price of collecting the Government duty, enervated by the false protection accorded them against healthy competition, our manufacturers of silver-ware have become such veritable lotus-eaters, that it is a relief to find them rising even to so small a manifestation of vigour as is implied by a growl at the Assay Office regulations. The decay of their craft is the inevitable penalty attaching to the purchase of protection against rivalry from outside, and the submission to a blighting tax at home. Hide it as we may, by talk about the dire results that would follow the absence of a Government guarantee of the quality of silver, the manner in which the tax is levied, through the manufacturer by the device of hall-marking, is even more vicious than the tax itself. The returns we have quoted show that the English public resents the compact made between the dealers and the Government at its expense. From the inartistic productions of the silversmith and from the double-barrelled tax, collected in the most extravagant way, it takes refuge in the unrestricted competitions of the electro-plater; or when the chance offers, buys direct from the American maker. And there is a curious Nemesis in the fact that this hall-marking system, taxing the English buyers of plate to shield its makers from foreign rivalry, does extensively, in the case of imported watches, actually protect the foreign against the English maker. All this, and many other of the absurdities and losses into which this method of the incidence of this suicidal tax has landed us, have been set forth over and over again in our columns. They came out with such power in the evidence before the Select Committee of the House of Commons, that the recommendation by that tribunal to abolish the obnoxious duty was inevitable. While declining to advocate the abandonment of compulsory hall-marking, the committee agreed that several changes in the practice of the Assay Offices are necessary, and it indicated some which, if carried into law, would reduce the list of Mr. Bingham's complaints. And this brings us to the practical issue of the questions involved. If Mr. Bingham and the Chamber of Commerce will look at the indisputable state of the silver trade—its relation to the Government on the one hand, and to its customers on the other, their line is clear. It is not to fiddle-faddle with little grievances about this Assay office or that; it is to go boldly in support of the Parliamentary Committee's recommendation of the abolition of the tax on silver. Freed from this incubus, the English silversmith has yet a future before him. But so long as that lasts, it is useless to haggle about the fees charged at Sheffield as contrasted with those imposed in London; to suggest improved methods of assaying, or to strive to get the Sheffield office opened an extra day per week. These lesser reforms will follow upon the carrying of the greater. The reasonable plan is to make this industry, like all others, free. It is to strike off its shackles, and to give it such chances of vigour as will bring to the Assay Office (if it must still exist) a rush of work that can only be accomplished by opening its doors not two or three, but six days a week.—*Leader from the Sheffield and Rotherham Independent.*

We hear that Birmingham manufacturers of electro-plate have received some good orders from the Australian and other Colonial markets.

ARTISTS AND THE SILVER TRADE.

THE following is a copy of a well-signed petition presented to Parliament, on Friday the 6th ultimo, by Mr. Mundella, M.P., and Mr. L. Courtney, M.P.

To the Honourable the Commons of the United Kingdom of Great Britain and Ireland in Parliament assembled, the humble petition of the undersigned artists, designers in metal work, educated in schools in connection with the Science and Art Department, South Kensington, most respectfully showeth:—

1. That your petitioners are greatly interested in the attempt now being made to abolish the taxation of gold and silver plate, and to alter the laws relating to hall-marking of those wares.

2. That your petitioners have long since found that the trade of the silversmith offers no inducement to artists to adopt it as a profession, owing to the limited demand for artistic silver productions.

3. That your petitioners are convinced that the duty of 1s. 6d. an ounce, which amounts, at the present price of silver, to a tax of 33 1-3 per cent. upon the value of the raw material, materially assists in limiting the demand for artistic productions.

4. That your petitioners are further convinced that the duty, coupled with the laws relating to the system of compulsory hall-marking, limits the number of manufacturers, inasmuch as the hindrances to trade are such as prevent "outsiders" from engaging in the business, although there is nothing in silver, as distinguished from other metals, offering difficulties to the amateur.

5. That your petitioners have great reason to believe that if the duty were abolished, and if hall-marking were rendered a voluntary institution under a system more in accordance with the practice of modern trade, an important development of the art of the silversmith might confidently be expected in the United Kingdom.

6. That the laws relating to the gold and silver trades have lately been under the consideration of a Select Committee of your honourable House, and that, with a single dissentient, the duties have been condemned, the report recommending their abolition "whenever the state of the revenue shall permit."

7. That although the Select Committee, by a majority of one, recommended that hall-marking should remain as at present—a compulsory proceeding, your petitioners humbly submit that the balance of evidence brought before honourable members was strongly in favour of a voluntary system of hall-marking.

8. That freedom of trade being an established principle in the case of all other kindred trades, a *prima facie* case was presented by several of the witnesses in favour of an extension of those principles to the gold and silver trades.

9. That artists have a direct interest in freedom of trade, which, as it affects the demand for commodities, opens out new fields for their employment, encouraging them to study, at home and abroad, with a view to the cultivation of their taste and the acquirement of knowledge of the respective manufactures.

10. That art would suggest that the quality of the material is of but little importance as compared with the artistic design and execution of manufactures.

And your petitioners therefore humbly pray that your honourable House, taking all these facts into consideration, will, "as soon as the state of the revenue shall permit," give effect to the recommendation of the Select Committee, by abolishing the duties upon gold and silver plate, and that the laws relating to the gold and silver trades may all be abolished, and that a new Act may be passed providing for a voluntary system of hall-marking, easily accessible to manufacturers and dealers throughout the United Kingdom.

And your petitioners, as in duty bound, will ever pray.

BRITISH SILVER.

THE quantity of silver obtained in 1878 from British mines was 397,471 oz., and most of the precious metal was found in combination with lead. The total value of the silver thus obtained in the year in question was estimated at £88,296 19s. 6d. In the same year the gold found in British mines weighed 702 oz. 16 dwts. 8 grs., and was estimated to be of the value of £2,848 15s. 2d. Nearly the whole of this British gold—namely, a fraction over 697 oz.—was procured in Wales, in the Clogau mine in Merionethshire. The balance of 5 oz. and a fraction was found near Wicklow, in Ireland, in 86½ lb. of ore. Of silver ore about 94½ tons were found in Cornwall in the Huel, Prince of Wales, and Redmore mines, which yielded silver to the value of £5,994 11s. 10d. The richest argentiferous lead ores are found in the Isle of Man, where the 3,920 tons of lead ore procured from the nine Manx mines yielded, in 1878, as much as 110,496 oz. of pure silver. In Wales, which possessed ninety-seven lead mines in eleven counties, the silver won in 1878 weighed 148,376 oz. England, with 266 lead mines in ten counties, produced 118,629 oz. of pure silver in the same year, while 14,320 oz. were got from the lead ore produced in Scotland, and 5,650 oz. from those of Ireland. The total quantity of British silver produced in the year was rather more than 11 tons, and the value was nearly £8,000 a ton.

Roman Jewellery.—While digging the foundations for a gasometer at Monaco, nine bracelets, a gold medallion and gold bust of Gallienus, the latter 2 in. in height, and eight gold medals have been discovered. Some of the bracelets are believed to be decorations belonging to a Roman general, under Probus. Gallienus was Roman Emperor between 260 and 268 A.D. Probus was Emperor from 276 to 282.

Silver-plated Ware on the Continent.—The Amsterdam correspondent of the *British Trade Journal* thinks that there is a market in Holland for English plated ware. He says that Messrs. Christofle & Co., of Paris, supply that country with the bulk of these goods and are practically free from competitors. It appears that this well-known Parisian firm has pretty well the run of the Continent, and the heavy import duties which Germany has imposed on plated articles has caused them to open a branch at Carlsruhe; the goods are sent from Paris finished in copper, and are then plated and finished in Germany ready for their German customers. Our manufacturers would certainly find it profitable to give this matter their attention.

Permanent Exhibition of Watches, Jewellery, &c., in Geneva.—We have previously informed our readers of the establishment of a permanent exhibition of watches, jewellery, and kindred articles at Geneva, and from the increasing list of exhibitors we may conclude that the affair is likely to succeed. The exhibition has now its own paper, *L'Industriel Suisse*; it contains a complete list of the exhibitors, and deals most intelligently with questions bearing on this movement, and the watch and jewellery trades in general. A lottery—that patent method for raising money on the Continent—is also connected with the exhibition, the lottery prizes are selected among the objects exhibited. Half of the proceeds of the next drawing are to be devoted to the destitute watchmakers and jewellers of the cantons of Geneva, Vaud, and Neuchatel. Berne, another watchmaking canton, could not be included in this charitable project, because in that virtuous canton lotteries are not considered legal transactions.

ANTIQUE PLATE.

THE letter from an "Old Hand," which appeared in our last number, very properly calls attention to the pernicious effects of the "Antique Silver craze" on the artistic and, as a sequel, industrial progress of our silver trade. As is well known, workmanship is only of secondary consideration; and as long as a piece of plate, be it ever so ugly, possesses the Elizabethan or Queen Anne hall-mark, it is certain to command a ready buyer, at a price altogether out of proportion with its intrinsic and antiquarian value. If there was a supply of such plate, the case would not be quite so bad; but it does not exist.

The *Times*, dealing with the same subject some time ago, stated:—"Old English plate, as represented by the few pieces which still exist, having escaped the wars of the Roses, the confiscation of Henry VIII., the commercial depression of his daughter Mary, the great rebound of trade and national life in Elizabeth's reign, when so many old things perished, the contest between Charles and his Parliament, when so much plate on either side went to the melting-pot, and though last, not least, the want of bullion in William III.'s time, which swallowed up almost all the old plate there was left . . . old English plate, we say, is very precious, and some of it very beautiful, and is, therefore, worthy of having a history and a literature of its own. But, unfortunately, what is very scarce and very beautiful is very much coveted. It is well known that where there is a demand there will always be a supply; but how supply a demand for a thing which is so scarce that it may be practically said hardly to exist? Must a wealthy man, who sighs for a side-board of old English plate, continue to sigh in vain? By no means! 'Let us make old plate for yonder millionaire,' say some of those banditti who are ever ready to pamper the fancies of the wealthy. Boldly quitting their provincial haunts, they have of late years shown their faces in town, and even in this London town itself, much as a Fra Diavolo or a Leone might show himself in Naples or Palermo. Like true bandits, it is not against the poor, but against the wealthy that their faces are set. It is not the needy but the rich which they ravish when they get him into their net. Under various disguises they long pursued their nefarious manufacture of old English plate with impunity. Marks were cut out of old spoons and church patens, and dexterously inserted into the bottoms of forged cups, bowls, and beakers. Not content with these "applications," the very marks themselves were fabricated, and so ample was the supply of these forgeries, that it has been well said by a recent writer in the *Quarterly Review* that an eager collector might bring back with him, after one day's drive through the streets of London, a whole cab load of fine old English plate. To such a pitch of daring had these practices been carried that they became a public scandal. Proceedings were taken against one or two notorious delinquents, who were tried, convicted, and have since partially expiated their offences by undergoing a term of imprisonment. It is probable, indeed, that like the big and the little fish in nets, the greatest offenders escape the clutches of the law, but the lesson has not been lost on them, and since the convictions which we have mentioned there has been wonderfully little of this brand-new fine old English plate in the shop-windows."

Thus thinks the *Times*; and Mr. Prideaux, clerk to the Goldsmiths' Company, tried to make us believe the same: but the fact is that the tons of forged Queen Anne plate said to have been melted down are now scattered over the shops of second-hand dealers, and no doubt much more is now adorning the side-boards of those favoured classes that can afford to cultivate such an expensive amusement as the collection of antique plate.

Proofs for these assertions are not wanting; only a few days ago some six hundred and fifty pieces were taken to Goldsmiths' Hall by a London banker, every one of which was pronounced to be a forgery. The plate has been impounded, and it is at Goldsmiths' Hall at this very moment. The company are seeking to recover a fine of £6,500 from a well-known silversmith in Oxford Street, who, unfortunately, had dealt in it, not knowing it was "forged" plate. The "forger" is, of course, unknown. It is commonly reported that similar plate has passed, without suspicion, through the hands of many a London silversmith. From an instance that came to our knowledge lately, it appears that even connoisseur's are deceived by it. How can we expect the silver trade to flourish with such demoralising elements at work? A correspondent in a contemporary justly says: "Apart from the dishonesty inseparable from a demand for a commodity so valuable as genuine antique plate, which offers such an inducement to unscrupulous manipulators, I maintain that, even when the law is not absolutely broken, the practice of tinkering up old, and exceedingly ugly, plate is diametrically opposed to the interests, not only of modern manufacturers and their workpeople, but that it is obstructive to art progress, and, consequently, destructive of our export as well as of our home trade. I use the word 'tinkering' advisedly. The greater part of second-hand plate is, were it not for its hall-mark, positive rubbish, fit only for the melting-pot. With but few exceptions, the designs are hideous, and the workmanship coarse in the extreme. Modern manufacturers copy it, first in obedience to the depraved taste of modern demand; secondly, because they are not capable of producing anything better, drawing and designing not having formed part of their education; thirdly, because the duty upon modern plate renders their production so expensive that second-hand plate passes readily from hand to hand, successfully competing with the new. I hold that the duty is at the bottom of the matter. Its injustice is second only to its impolicy. It is a premium on dishonesty, and it encourages the 'tinker' at the expense of the earnest craftsman. It provides work for jobbing silversmiths, while, at the same time, skilled labour is left to struggle on on 'half-time.'"

All honest silversmiths are certainly of opinion that these pernicious practices must be stopped, and the remedy is in their own hands. They must combine and rid themselves of every obstacle that prevents the artistic progress and the industrial development of the trade. With perfect freedom it will strive forward as rapidly as all our other art industries have done; the necessary talent and capital will be readily forthcoming. If a depraved taste or insane fancy exists they should not lend themselves to foster and to perpetuate it, but attract the public eye to something which is worth their money and a credit to the craft. Let them produce something which does not need the recommendation of a hall-mark, something that has *a sterling and permanent* value independent of that misleading sign of officialism. There are no doubt many who have dabbled in antique plate wishing that such a thing as a hall-mark never existed, and are convinced that its protection to the public is a delusion. In this case the hall-mark has certainly proved most profitable to the forger and unscrupulous dealer; in fact, without it the nefarious trade could never have been carried on.

We may here very appropriately call the attention of the trade to Mr. Cripps' valuable work on old English plate, lately from the press of the well-known publisher, Mr. J. Murray, Albemarle Street, London. It affords a mass of information which will prove most useful to all dealers in plate. The trade is much indebted to Mr. Cripps for his labours, and it is only to be regretted that the work was not given to the world sooner. The book is founded upon the papers and tables of C. Octavius S. Morgan, the well-known antiquarian, himself an ardent collector of old plate, and the fortunate possessor of the finest collection of old clocks and watches.

TECHNICAL EDUCATION.

APPRENTICESHIP: SCIENTIFIC AND UNSCIENTIFIC.

By Silvanus Phillips Thompson, D.Sc., B.A.,
Professor of Experimental Physics in University College, Bristol.

A Paper Read Before the Society of Arts.

(*Continued from page* 93.)

He is placed under a journeyman carpenter, who is supposed to look after him, but who, having his own work also, and not being paid to teach apprentices, nor, indeed, qualified so to do, loses no opportunity of neglecting him. The boy must do some work, so the first odd job that may be supposed easy enough is set before him, he has the very vaguest instructions given him, and nobody troubles to explain to him the difficulties he will encounter, or tell him how to overcome them. He spoils two or three pieces of wood before he has produced anything, and is simply sworn at or threatened with blows at each failure. Of instruction there is none, for the workman who ought to have instructed him could not do so if he would, having been reared under the same vicious system; and would not if he could, as he has no mind to be displaced by a clever young workman who could do his work for less wages. So the lad learns, with weary months of aimless and unsystematic labour, to ape the tricks of the elder workmen, falling irrevocably into their worst methods, and acquiring their slang talk. He is, of course, a perfect slave to the inaccurate "rules of thumb," handed down in the traditions of the shops. As to consulting a book about his work, the idea is too ridiculous to be named, and he learns to laugh in turn at the idea that he can be taught anything valuable in his craft except by "a practical man." At first, before his hands have acquired any rude kind of skill, he is the common drudge, must run for one man's coat, and for another's tobacco. From the moment when he has obtained some skill with his fingers he must be continually producing paying work, and so, without regard to that which would be best fitting him for doing further work, he must drudge on, planing mouldings or shaping legs of stools by the year together. He does not know how to describe his work, could not read his instructions aright if given him, as they ought to be in the form of a working-drawing, much less could he himself set out a working-drawing for another to work by. So he grows up an uninstructed, uneducated, bad workman, and having served his seven years' of apprenticeship duly, cannot well be forbidden entrance to that haven of bliss, the Union of his trade, where having entered he can claim to be paid, at least, as well as his fellow workmen. And this is apprenticeship.

Does the picture seem too grotesque or too strongly coloured to be true? I can assure you it is a photograph from real life, and not very remote from being typical of apprenticeship as it exists in many a workshop. What is the state of apprenticeship amongst the mechanical engineers? Let me give the opinion of Mr. James Hopps, as recorded in his report to this Society upon Mechanical Engineering at the Paris Exhibition.*

"In England at the present time, as soon as a boy is sent to learn a trade all mental instruction is discontinued. He conceives that he has only to learn to work, and in this he is very much encouraged, both at home and in the factory; at home, by the indifference of his parents; in the factory, by the indifference of master and foreman. In fact, he is looked upon as a nuisance and in the way for the first year or two; he is set to do the most trifling jobs, and discipline is often so loose that he becomes a confirmed skulking sloven, his powers of mischief being the only faculties that evince development. The reason for work being done in a particular way is rarely put before him, and it is only when he is grown to man's estate that he begins to be regarded as of any value. The foreman, perhaps, notices what branch he shows most aptitude for, vice, bench, or lathe, and to this he is put and kept for the remaining term of his apprenticeship. By this means he becomes, perhaps, a fair turner or fitter, but rarely both. The neglect of mental training during his apprenticeship is so absolute that he is a worse scholar by far than when he left school. He lives and works—it may be steadily and soberly—but, at the best, like a mere machine. In many cases he does not know how to make the simplest calculation in relation to his work."

It is not needful to multiply instances; every one who has thought over the subject at all must recognise the utter want of method and reason which pervades the training of apprentices in most of the handicraft trades, and must know how true is the oft-repeated complaint on every hand that good workmen are not to be had. In the old days, when the master was a craftsman first, and, perhaps, a capitalist in consequence, matters were very different, for the master charged himself with the education of his apprentice, taking a pride in instructing him in all he knew of his work, and treating him as one of the family—almost as his son; and you will doubtless remember that it was no uncommon thing, as with the industrious apprentice portrayed to us by Hogarth, for the apprentice to become his master's son-in-law. We have but to read the apprenticeship clauses of the time-honoured oaths administered on admission into the ancient guilds to recall the profound strength of this obligation of the master towards those who were to hand down to the future generations the secrets of the craft. But all this changed when changing social conditions replaced the master craftsman, worker in his craft, and paternal in his relations to his apprentices, by the capitalist, a non-worker, who could not instruct his apprentices, and could only set them to work through the agency of a middleman or overlooker. That which was logical, though perhaps unscientific, in the old apprenticeship of the pre-scientific middle ages, in this handing down of the craft from generation to generation of workers, became not only unscientific but illogical as the great, though almost imperceptibly slow, changes of the social fabric worked their inevitable course. So that what we to-day call apprenticeship is but the withered husk of the once living institution, lacking in all those essential elements which gave it vitality and coherence.

If, then, the present so-called apprenticeship, handed down to us as the descendant of the old paternal apprenticeship and inheritor of its name, and of its legal prestige, and of scarcely aught else beside, must be condemned as irrational, unscientific, and out of harmony with the social conditions of the age, what can be suggested as a logical and scientific substitute to take its place in social economy? What system is there, either actual or possible, that can do for our future craftsmen and tradesmen that which the old paternal apprenticeship endeavoured in old time to do? What are the principles that must underlie the attempt to reconstruct in a manner adequate to modern, social, and industrial conditions, the rational scientific apprenticeship of the future?

(*To be continued.*)

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* "Artisan Reports on the Paris Universal Exhibition of 1878." (Published for the Society of Arts.)

THE

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A MONTHLY TRADE JOURNAL,

Devoted to the interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades; published at Milner's Buildings, Moorgate Street (Opposite Moorgate Street Station), London, E.C. Booksellers and Newsagents supplied by Messrs. Catty & Co., 12, Ave Maria Lane, Paternoster Row, E.C.

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Liquidations by Arrangement or Composition.

Bentham, Thos., Oak Terrace, Old Dover Road, Shooters Hill Road, Blackheath, watch and clock maker and jeweller. Jan. 26. J. F. Terry, sol., 14, King Street, Cheapside.

Cohen, Daniel Simon, 65, Hatton Garden and Clifton Villas, Maida Hill, manufacturing goldsmith and diamond merchant (separate creditors). Jan. 27. Lewis and Lewis, sols., Ely Place, Holborn.

Cohen, Simon, Hatton Garden and Clifton Villas, Maida Hill, manufacturing goldsmith and diamond merchant (separate creditors). Jan. 27. Lewis and Lewis, sols., Ely Place, Holborn.

Jacobs, Hyam, Sapphire Street, late Atlas Buildings, James Street, both Cardiff, jeweller. Jan 24. Morgan and Scott, sols., Cardiff.

Lawrence, Christopher George, Beech Street, Barbican, jeweller, &c. Jan. 31. Carter and Bell, sols., 5, Eastcheap.

Layman, Fred Richard Leopold, Gabriel's Hill, Maidstone, gold and silversmith and watchmaker. Jan. 29. Norton and Sons, sols., Town Malling, Kent.

Marcus, Henry, trading as Kennedy and Co., and Henry Mason, 226, Piccadilly, late Northumberland Street, Strand, money scrivener and jeweller. Jan. 15. P. Collings, sol., Buckingham Street, Strand.

Wolf, Geo. Garcia, trading as G. G. Wolf and Co., 174, Edgware Road, and 61, High Street, Kensington, jeweller. Jan. 31. Lumley and Lumley, sols., 37, Conduit Street, Bond Street.

Bentham, Thos., Oak Terrace, Old Dever Road, Shooters' Hill Road, Blackheath, watch and clockmaker and jeweller. Feb. 18. Morphett and Hanson's, accountants, 15, King Street, Cheapside. March 8, at 2. J. F. Terry, sol., 14, King Street, Cheapside.

Bowker, James Arthur, Devonshire Buildings, Huddersfield, jeweller. Feb. 17. Ramsden, Sykes and Ramsden, sols., Huddersfield.

Elias, David, and John David Elias, trading as David Elias and Son, Bangor, Carnarvonshire, watchmakers, &c. Feb. 20. Queen Hotel, Chester, March 11, at 2. J. B. Allanson, sol., Carnarvon.

Haydock, Joseph Ely, Withington, late Gaythorne, Manchester, jeweller. Feb. 21. Sutton and Elliott, sols., Fountain Street, Manchester. March 17, at 11.

Pearce, William Bradford, watchmaker and silversmith. Feb. 16. A. Neill, sol., Bradford.

Rubenstein, Elias, Brearley Street West, Birmingham, dealer in jewellery. Feb. 17. S. N. Solomon, sol., Ann Street, Birmingham.

Dividends.

Reid, William (Bkt), Bishop Street, Coventry, watch manufacturer. Div. 3s. 6d.; Feb. 27 and two subsequent Fridays between 11 and 4. E. T. Pierson, Coventry.

Trustees Appointed.

Beaumont, Charles R., (Liq), Withington, near Manchester, jeweller. Tr., A. H. Lamb, Princess Street, Manchester, accountant.

Caspers, Alfred and Chas. J. Caspers, trading as Caspers & Co., (Bkt), Walbrook, watch importers. Tr., J. Seear, 33, Holborn Viaduct, accountant.

Adjudications of Bankruptcy.

Wiggins, John, trading as John Wiggins & Son, Claremont Road, Handsworth, jeweller. Feb. 7, at C.C., Birmingham, March 2 at 2. Cole, Registrar.

PATENTS.

Patents Granted in Foreign States.

United States of America.

223,043. William Hamilton, Jr., of Providence, R.I., for "A bracelet,"—Application filed 29th October, 1879.

223,211. James D. Allen, of Amboy, Ill., for "A watchmaker's tool."—Application filed 31st October, 1879.

223,673. A. E. Hotchkiss, of Cheshire, Conn., for "A clock movement."—Application filed 6th October, 1879.

223,803. Lucien J. Falize, Jr., of Paris, France, for "Ornamentation of jewelry and other articles."—Application filed 15th May, 1879.

Notices to Proceed.

119. George Evans, of Clerkenwell, in the county of Middlesex, has given notice in respect of the invention of "Improvements in solitaires and studs."

3863. Auguste Lion, of Paris, in the republic of France, Jeweller, has given notice in respect of the invention of "Improvements in articles of jewellery having a scale-like appearance, and in the manufacture thereof, specially applicable to bracelets, necklaces, chains, and other such like articles."

4208. Louis Frederic Portebois, of 10, Rue de la Fidélité, Paris, in the republic of France, Clockmaker, has given notice in respect of the invention of "An improved calendar."

5328. Edwin Ambrose Brydges, of the firm Brydges and Co., Patent Agents, of 32, Belle Alliance Strasse, in the city of Berlin and empire of Germany, has given notice in respect of the invention of "Improvements in chronometer movements, applicable to marine chronometers, watches, astronomical and other timekeepers."—A communication to him by August Ernst Müller and Johann Pollak, both of the city of Vienna, in Austria.

Patents which have become Void.

348. William Thomas Kerry, of 10, Sotberon Road, King's Road, Fulham, in the county of Middlesex, for an invention of "A new or improved polish for cleaning, reviving, and renovating jewellery, plated ware, &c.—Dated 26th January, 1877.

Applications for Letters Patent.

415. William Henry Douglas, of Hourbridge, in the county of Worcester, and Evan Foster, of Kidderminster, in the county of Worcester aforesaid, Watchmakers, for an invention of "Improvements in illuminated time-pieces."—Dated 30th January, 1880.

440. Francis Silveston, of Coventry, in the county of Warwick, Watch Manufacturer, for an invention of "An improvement or improvements in or relating to watches and other time-keepers."—Dated 31st January, 1880.

707. Alexander Melville Clark, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, for an invention of "Improvements in the manufacture of jewellery, etc."—A communication to him from abroad by Messieurs Veit and Nelson, of 11, Rue Bergère, Paris, France.—Dated 17th February, 1880.

796. Joseph Warren Zambra, of the firm of Negretti and Zambra, of Holborn Viaduct, in the city of London, Meteorological Instrument Makers, for an invention of "Improvements in self-registering thermometers."—Dated 23rd February, 1880.

Grants of Provisional Protection for Six Months.

303. William Morgan-Brown, of the firm of Brandon and Morgan-Brown, Engineers and Patent Agents, of 38, Southampton Buildings, London, and 1, Rue Lafitte, Paris, for the invention of "Improvements in telephone signal apparatus, and in keeping clocks in unison."—A communication to him from abroad by George Henry Bliss, of Pittsfield, Berkshire, Massachusetts, United States of America.

152. Joel Cadbury, of the firm of Green, Cadbury, and Richards, of Birmingham, in the county of Warwick, Manufacturers, for the invention of "Improvements in solitaires, sleeve-links studs, and other like dress fastenings and ornaments."

541. Herbert John Allison, of the firm of Allison, Brothers, Patent Agents, of 41, Southampton Buildings, Holborn, in the county of Middlesex, for the invention of "Improvements in cylinder watches."—A communication to him from abroad, by Edouard Gillot, of Paris, in the republic of France.

Optometer.—On improved optometer has lately been patented in America, said to be most useful to opticians in ascertaining the limits of distinct vision, and in adapting spectacles to the eye. The device consists of a tube mounted adjustably on a standard, and having in one end a double convex lens, through which may be seen a translucent disc having a number of small dots printed on it. This disc is carried by a slide which is movable in the tube, and carries an index extending through a slot in the side tube, and upwards over a scale formed upon the upper surface of the tube. The graduations of this scale extend from a zero point towards the left for near-sighted tests, and from the same point to the right for long-sighted tests. The number of the graduations correspond to the focal lengths of the different glasses, and when the dots in the disc are seen distinctly the index points to a number on the scale indicating the number of the glass adapted to the particular eye under test.

To Remove Nitrate of Silver Stains.—Dr. Kraetzer, of Leipsic, proposes, as a substitute for potassium cyanide in the removal of stains made by lunar caustic, or silver nitrate, the following mixture:—10 grammes ammonium chloride, 10 grammes corrosive sublimate, dissolved in 100 grammes of distilled water, and preserved in a glass-stoppered bottle. He says that with this solution the black stains may be removed from linen, woollen, and cotton goods perfectly, without injury to the goods. It will also remove stains on the skin; but, although less poisonous than the cyanide, it must not be forgotten that it is a corrosive poison. For the skin we prefer to apply tincture of iodine, or a solution of iodine in iodide of potassium, followed by strong aqua ammonia; if slower it is safer, both to use and to keep in the house.

Industrial Art School in New York.—A new free school for workers in metal and wood, says the *Scientific American*, was opened on January the 13th, at No. 31, Union Square, under the management of the trustees of the Metropolitan Museum of Art. The object of the school will be to teach carvers in wood, engravers on gold, silver, steel, and other metals, and others how to design artistically, so as to do away with the old-fashioned method of designing from copy, and in this way to enable the workers to obtain higher prices for their work. The students will be allowed to copy from models brought from the collections of the museums.

Art Exhibition at Amsterdam.—The *Antiquary*, a new and excellent publication devoted to antiquarian subjects, edited by Edward Walford, M.A., late editor of the *Gentleman's Magazine*, informs us that a loan exhibition of gold and silver objects of artistic value, executed before the commencement of the present century, is to be held in the *salons* of the Society of Dutch Artists, Rokin, Amsterdam, in April, May, and June next. The exhibition will embrace objects used for the celebration of different rites, by public and private corporations; for domestic use; personal ornaments; select coins and medals illustrating the history of art, or bearing names of engravers; documents, portraits, books, etc., bearing upon goldsmiths and their work. English and other foreign collectors are invited to contribute, so as to give the affair an international character.

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WATCHMAKERS' SCHOOL AT GLASHUETTE (SAXONY).

THE Watchmakers' School at Glashuette, one of the practical results of the German Watchmakers' Society, has up to the present accommodated its pupils in a building generously lent by the corporation of that town, but we learn from our German contemporaries that the school is to have its own building before long. The Government of Saxony, quite aware of the importance of the industry they are fostering, has granted 2,200 marks towards the expenses of the school-year 1879-80, 2,000 marks for the purchase of tools and machinery, and has besides offered to lend the money for the construction of a suitable building. The corporation of Glashuette provides the building site free of charge, and the trade supplies 5,000 marks as a basis for the building fund.

Glashuette was recently honoured by a visit from the King of Saxony, an earnest patron of the industrial arts. He made himself personally acquainted with some of the leading watch and watch-tool factories of that town, and we may depend that Mr. M. Grossmann, to whom, as mayor of the town, fell the honourable task of receiving and entertaining his Majesty, did certainly not lose so favourable an opportunity for impressing upon his Majesty the great value of such an institution as the Horological School of Glashuette. We shall not be far wrong if we attribute the lively interest of the Saxon Government in this movement to this royal tour of inspection.

The annual report of the school, which we have now before us, speaks well for the undertaking. It was opened 1st May, 1878, with ten pupils, but this number was increased during the year to twenty-one. The second school-year began with twenty-eight pupils, a progress certainly rapid enough to satisfy the most sanguine promoters. The school has a great advantage in the services of its able director, Mr. G. H. Lindemann, a man of exceptional horological talent and skill, and specially qualified for the difficult but honourable post he holds. In the department for practical work he is ably assisted by Mr. Carl Maucksch.

The programme of the school is a most comprehensive one: the theoretical and scientific section includes algebra, geometry, trigonometry, applied physics and mechanics, drawing, bookkeeping, and French and English languages. Every subject is, of course, dealt with in its special relation to horology. Among the practical work taught may be mentioned the completion of tools, construction of models of balances, of apparatus for demonstrating the various actions in watch and clock work, of astronomical clocks, marine chronometers; also regulating, repairing, etc.

Young Englishmen desirous of learning the watchmakers' art or of improving themselves in it, with the necessary means (by no means high) at command, would do well to spend some time in an institution like this, where at the same time they will have the opportunity of learning French and German, an accomplishment which becomes daily more necessary and more valuable. These young men would return with knowledge which, applied to our watchmaking industry could not but prove profitable; they would help to rub off some of the pernicious prejudices which cling to it. From a sanitary point of view also such a change would be beneficial, as the town of Glashuette is situated in a healthy and most beautiful part of Germany.

While on the subject of horological schools, we are pleased to mention that there is some probability of our having a similar institution in our own Clerkenwell at no very distant period.

TO WATCHMAKERS, JEWELLERS, &c. Advertiser wishes to meet with a good Business in a market town, returning from £1,200 to £2,000 yearly. Must bear the closest investigation.—Address Messrs. J. COLLYER AND SON, 28½, Ludgate Hill, Birmingham.

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TO WATCHMAKERS, and JEWELLERS.—For Disposal, in one of the principal thoroughfares of Hull, on account of the death of the Proprietor, an Old-Established Business (over half a century). Small capital required. For particulars apply:—G. Wokes, 1, Osborne Street, Hull. References kindly permitted by M. Samper, Esq., 28, Hatton Garden, London, E.C.

TO WATCHMAKERS and JEWELLERS. To be Sold. A first-class Watchmaker and Jeweller's Business, in the North of England; established in 1864. Stock (if desired) at valuation. Freehold Premises may be bought or taken on long lease. Possession at once. For particulars apply to JOHN W. TEALE, Solicitor, Middlesborough.

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THE WATCHMAKER, JEWELLER AND SILVERSMITH'S TRADE JOURNAL.

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

Entered at Stationers' Hall.—Registered for Transmission Abroad.

CONTENTS.

	PAGE
The Construction of a Simple but Mechanically Perfect Watch	125
Practical Instructions to Jewellers, Silversmiths and Electro-platers	127
The Silver Trade	128
Our Literature	128
Hints to Repairers	129
Bronzes	130
Correspondence	130
Queries and Answers	130
Finishing and Lacquering the Brass Surfaces of Timekeepers, etc.	131
Anti-Oxide	131
Watch Trials in America	132
The Art of the Silversmith	133
Technical Education	134
White Nickel Bronze	136
Pneumatic Clocks in Paris	136
Patents	i
Monthly Record of Bankruptcies	ii
Directory	iv
Advertisements	i—xii

No. 59.—Vol. V.] APRIL 5, 1880. [Subscription, 5s. per Annum. Post Free.

THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.*

By M. Grossmann, Watch Manufacturer, Glashuette (Saxony).

(*Continued from page* 112.)

CHAPTER I.

The Frame.

1. This part must be the beginning, because the way in which it is made, influences most essentially the physiognomy of the movement, the arrangement of its organs, and even the shape of the case. A watch, as well as any other machine constituted mainly by rotating parts, requires a frame for sustaining both ends of each moving axis; and this frame has to fulfil the same general mechanical requirements as in any other machine.

2. On looking over the frames, as they are made in the different manufactories, we may distinguish three different modes of construction :

The full plate movement.
The three-quarter plate movement.
The movement with cocks—or skeleton movement.

We will, in the first place, have to compare these three systems for the purpose of choosing the one offering the greatest advantages for the manufacture, and the best conditions for the solidity and good service of the watch.

3. The movement with cocks is almost exclusively adopted in the Swiss manufacturing, and it must be acknowledged that it is, more than any other one, calculated to exhibit the mechanism of the watch favourably to the eye and give a rich look to the movement. At the same time it is of a more complicated nature, and it can not be manufactured or finished for the same price and in the same time as a full or three-quarter plate movement. The same observation applies to the taking to pieces and putting together; and it is not unlikely that the workmen employed in the manufacturing, as well as the repairers, would protest against this system if, instead of being sanctified by the practice of a rather long period, it were to be introduced now.

4. The frame, with cocks, of a horizontal watch requires ten to eleven screws, for the cocks only, and sixteen steady pins; the frame of a three-quarter plate movement only seven screws and six steady pins. Thus, the adjustment of the three pillars balances itself by the adjustment of three to four screws and nine to ten steady pins; an undeniable advantage in favour of the three-quarter plate movement, when cheap and quick manufacturing is kept in view. Besides, there are four cocks to be made instead of

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the upper plate, and it is especially the consideration of the shaping and finishing of these numerous parts, which shows an essential economy in favour of the three-quarter plate.

In repairing, the same inconveniences prevail; the number of the separate parts is too great in the movement with cocks, which occasions necessarily a loss of time in the operations of taking to pieces and putting together.

5. The stability of the depths, together with the vertical position of the pinions, is endangered by each bending of a steady pin in the frame with cocks. It is for all these reasons, that some of the best Swiss manufacturers have dispensed with the cock of the third wheel by annexing the hole for this wheel to the centre wheel cock, because this depth, being the highest above the level of the pillar plate, might suffer most from the last-mentioned danger. With this course of ideas, it is only surprising that the same reasons have not at once led to a more radical change of system.

6. It may be asserted as a merit of the movement with cocks that it affords more facility in taking out certain parts, *i.e.*, the barrel, in case of a broken spring, or a piece of the clickwork, or stop-work in disorder. But even this little advantage does not really exist, because, for taking out the barrel, if the hole in the plate for this latter is not too wide, or if the steady pins of the barrel cock are rather long, the centre-wheel must be taken off first, and for doing this, if the spaces are limited, it is often required to lift also the cock of the third wheel. Then there are four screws to be unscrewed instead of the three of the three-quarter plate. Thus there remains the more sightly exposition of the train, as the only advantage of the movement with cocks.

7. The three-quarter plate movement is very rarely made in Switzerland; but so much the more in England, where, for about twenty years, it has obtained a pronounced preference in place of the old full-plate design. It secures the relative position and vertical standing of the moving axes better than the Swiss system, and requires a less number of pieces, and less time and trouble in repairing, still leaving sufficient facility in taking out the parts of the escapement.

8. The arrangement of the train in these two kinds of frames is, however, exactly the same, so that any three-quarter plate movement might be transformed into one with cocks by merely taking off the pillars and upper plate, and substituting them by cocks for each moving axis.

9. The full-plate movement, on the contrary, admits and even requires a quite different arrangement of the train. It is the most ancient of all frames in watch-work, and has been always in great favour in England. This kind of frame has also been generally adopted by the watch factories of the United States.

10. It affords the possibility of making the balance of greater diameter than in any of the other frames; but this is an advantage of no great importance, because it has long since been ascertained that an excessively large balance, approaching more to the effect of a fly, is not commendable for a good time-keeper. Most likely it was the reduction of the size of balances which caused the English makers to adopt the three-quarter plate movement. At any rate it is not advisable to put the balance of a full plate watch as close to the centre of the movement, as is customary, because an arrangement of this kind subjects the vibrations of the balance to the full influence of each circular motion applied to the watch. By approaching the balance to the edge of the plate, this influence is reduced to its smallest value.

11. The full-plate frame allows of a much easier and more spacious arrangement of the train, and, especially in fusee movements, the wheels and pinions can be made larger than in a three-quarter plate frame, which is certainly an advantage. But on the other hand, having a main spring of the same breadth, the full-plate movement requires a considerably greater height of frame and case. This was tolerable at the period when the taste required a case with strongly convex backs, but the fashion of our days insists upon having the backs flat, or nearly so, and this caused the necessity of abandoning the full-plate system, lest the cases should have too disproportionate a height.

12. The full-plate movement is undeniably the most simple; it can be executed with two cocks only (those of the balance), and with an economy which no other system affords to the same degree.

13. The taking to pieces and putting together of a full-plate watch has inconveniences which can only be found supportable by a long practice with this kind of movement. The pottance which carries the lower balance pivot must necessarily overlap the extremity of the fork, or the rim of the escape wheel in case of a horizontal watch, and the workman who takes down the upper plate without the necessary precaution, will invariably break the lower pivot of the pallet staff, or the escape pinion in the horizontal watch. This happens very often to repairers who take English watches to pieces without attentively considering their arrangement. In fact, to avoid an accident of that kind, the movement must be put together and taken to pieces on the upper plate, which is a very inconvenient method, especially in fusee movements, where the tension of the main-spring must be adjusted anew after each taking down. It is true all these objections might be easily eliminated by dispensing with the pottance and setting the lower balance hole in the pillar plate, but an arrangement of this kind would not offer the same certitude of position and end shake of the balance staff.

14. The examining of the escapement, also, in a full-plate movement cannot be made with the same ease as in a movement otherwise arranged. Likewise it is impossible to make alterations on the escapement, or to clean it, or to give it fresh oil, without taking the whole movement to pieces.

15. Having thus balanced the merits and inconveniences of these three systems of movements, it will not be difficult to draw the conclusion, *that for the watches of our period the full-plate movement is not admissible; and that from the other two arrangements the three-quarter-plate movement is preferable for its greater solidity and economy in the execution.*

16. A slight saving might be made in the manufacture by omitting the two lower bridges; the plate would then only be turned out a little on the dial side, just enough to make up for any unevenness of the dial. The place for the barrel and motion work, and even for the lever escapement, can easily be provided by circular sinks made on the lathe. In the same way, a little advantage in the execution of a three-quarter-plate frame could be secured by dispensing with the pillars, and making the upper plate sufficiently thick to screw it directly to the lower plate, securing it in position by three good steady pins. For flat watches this method is to be recommended, as it gives additional solidity. The room for the moving parts must be hollowed out on the lathe. Watches in thin gold cases, thus made with two solid plates, would appear more weighty than they would with plates of common thickness. The setting of the jewels is not so convenient as when it is done in the bridges, but with properly devised tools there is no difficulty in setting them directly into the plate.

17. The pillars ought not to be placed close to the periphery of the upper plate; on the contrary, they will better answer their purpose if put a little more inside, because the plates cannot be so easily deflected in screwing down when the shoulder of the pillar is not quite correct and square. The two pillars near the barrel ought to be so placed that a straight line from the one to the other comes as near as possible to the barrel centre. The barrel is the reservoir of the moving force, and therefore the frame must be so constructed that it possesses the greatest strength at this part.

(*To be continued.*)

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTROPLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. XII.

(Continued from page 113.)

COPPER DEPOSITS.—When treating of the cleansing processes of metals, we stated that it was often useful and sometimes even indispensable to give certain metals or poor alloys a coating of copper or brass previous to the application of precious metals. We shall now describe in detail how the deposition of copper and brass is to be done so as to secure good results.

By Dipping.—Copper deposits are obtained either by simple dipping or galvanic action, according to the metal under treatment and the result required. Copper deposits by dipping are seldom practised except upon iron, and are generally wanting in lasting qualities, since, from the thinness of the deposit, the iron is not protected against atmospheric influences; in fact, it rather accelerates oxidation. The iron is steeped in a solution of sulphate of copper, 3½ ozs.; sulphuric acid, 3½ ozs.; water, 1 to 2 gallons, for a short time, and it becomes covered immediately with a coating of brilliant red copper, having a certain adhesion; but if left there for several minutes, the deposit of copper is thicker and muddy, and the least rubbing will detach it from the iron. In this case compress it by means of rollers or a draw plate in order to impart a certain cohesion to the particles of copper. Small articles, such as hooks, pins, or nails, are coppered by jerking them about for a certain time in sand, bran, or sawdust impregnated with the above solution, diluted with three or four times its volume of water.

By Battery.—Electro deposits of copper are obtained by decomposing a double salt of copper with another base, such as the double cyanide of potassium and copper. This process is equally well adapted to all metals, and the deposits are fine, lasting, and their thickness is entirely regulated by the will of the operator. Dissolve about 16 ozs. of sulphate of copper in 2 gallons of water, and add a solution of carbonate of soda until no more precipitate is formed; collect the green precipitate (carbonate of copper) thus obtained upon a cloth filter, and wash it several times with water, then stir the washed carbonate of copper in water, to which cyanide of potassium is added until the carbonate is entirely dissolved and the solution is colourless. It is well to add a small excess of cyanide, which will increase the conducting power of the liquor. This bath may be employed hot or cold, and requires an intense electric current for its decomposition. A copper plate or foil forms the anode, and as it slowly dissolves, nearly makes up for the loss of copper in the bath which has deposited on the negative pole. This anode must be removed where the bath does not work, because it will be dissolved even without an electric current, and the bath having been overcharged with copper, which is indicated by a blue or green colour, will require a fresh addition of cyanide to be in good order. This bath is neither economical nor very reliable. Practice has taught us that the following formula is preferable:—

Water, 2 gallons;
Acetate of copper (crystallised), 6½ ounces;
Carbonate of soda (crystals), 6½ ounces;
Bisulphate of soda, 6½ ounces;
Cyanide of potassium, pure, per cent., 6½ ounces.

For this bath the acetate of copper is put first into the vessel, and moistened with sufficient water to make a homogeneous paste. This salt, like flour, will float on the surface if too great a body of water is added. The carbonate of soda and some water are added to this paste, and, after stirring, a light green precipitate is formed. Three pints more water are then added with the bisulphate of soda, and the mixture becomes of a dirty yellow colour. Lastly, add the remainder of the water and the cyanide of potassium, and after the dissolution of the salts, a colourless liquid remains, which is the electro-copper bath. If after the complete solution of the cyanide the liquor is not entirely colourless, add more cyanide. If a perfectly limpid bath is desired, pass it through filtering paper, or decant it after settling; this bath requires an electric current of a mediate intensity for its decomposition. The copper anode should have a surface nearly equal to that of the immersed objects. Large pieces are generally kept hanging and motionless in the bath, whilst small articles are moved as much as possible, which is always to be preferred, especially with warm baths. If it were always possible to obtain a pure cyanide of potassium, this formula would be satisfactory in every case; but it is very difficult to find a perfectly satisfactory cyanide of potassium. The following formulæ require a cyanide containing from 70 to 75 per cent. of the real article:—

Cold Bath for Iron and Steel:—

Bisulphate of soda, 18 ounces;
Cyanide of potassium, 18 ounces;
Carbonate of soda, 36 ounces;
Acetate of copper, 17 ounces;
Aqua ammonia, 12½ ounces;
Water, 5½ gallons.

Warm Bath:—

Bisulphate of soda, 7 ounces;
Cyanide of potassium, 25 ounces;
Carbonate of soda, 18 ounces;
Acetate of copper, 18 ounces;
Aqua ammonia, 10 ounces;
Water, 5½ gallons.

Hot or Cold Bath for Tin, Cast Iron, or Large Articles of Zinc:—

Bisulphate of soda, 10 ounces;
Cyanide of potassium, 18 ounces;
Acetate of copper, 12½ ounces;
Aqua ammonia, 7 ounces;
Water, 5½ gallons.

For small articles of zinc, which are generally coppered in a perforated ladle and in nearly boiling baths:—

Cyanide of potassium, 25 ounces;
Bisulphate of soda, 3½ ounces;
Acetate of copper, 16 ounces;
Aqua ammonia, 5½ ounces;
Water, 4 to 5½ gallons.

To prepare these different baths, dissolve all the salts in about 4 gallons of water (rain or distilled water preferable), except the acetate of copper and the ammonia, which are dissolved apart in the remaining gallon. These two solutions are mixed, and that of copper and ammonia, which was of a magnificent blue, must become entirely colourless. When the liquors are not colourless there is a deficiency of cyanide of potassium, which must be added until entire discolourisation takes place. The bath is ready to work when subjected to the action of the electric current. The cold baths are put into well joined tanks of oak or fir-wood, lined inside with gutta percha. The vertical sides are also covered with sheets of copper, which act as the soluble anode, and reach to just below the top edge of the tank. This anode is connected by the clean extremities of a conducting wire to the last copper or carbon, that is to say, to the positive pole. Fix a stout brass wire upon the top of the tank, without any point of contact with the soluble anode, and connect by a second wire, with the last zinc or negative pole of the same battery.

(To be continued.)

THE SILVER TRADE.

A MOST instructive lecture was delivered on the 17th ult., at the Society of Arts, on the "Art of the Silversmith," by Mr. W. H. Singer, of Frome; and to satisfy the large number of our readers interested in the subject, we have asked permission to reproduce the same in our columns.

The lecturer, who takes a deep interest in the silversmith's art, and who is well acquainted with the productions of the craft of all ages and of all countries, naturally deplores its present low condition. He has devoted much time to the question of how fresh energy can be imparted to this languishing industry, so as to raise it again to the important rank it once held. We have ourselves been occupied with this problem for years, so that it is no surprise to us that Mr. Singer should have found that the *only* solution is to be found in the establishment of *perfect freedom, and a thorough system of technical education.* (The means for the latter are already in existence, only they are at present applied to illegitimate purposes.) The lecturer rightly concludes that the silversmith's art can never again flourish until it enjoys the freedom of all the other industrial arts, until the crushing duty and the unjust plate license are abolished, and the hampering hall-marking laws altered. The discussion which followed the lecture shows that the duty at any rate is doomed, all the speakers agreeing that it was injurious to the best interests of the trade and the public. As regards hall-marking, such unanimity does not yet prevail; some would like to make a clean sweep of it altogether, at least in connection with the Goldsmiths' Company; others prefer to substitute a voluntary system; and another section (a happy-go-lucky class which has probably never given the matter a thought) is satisfied with existing arrangements. The general feeling, however, is that a voluntary system would answer all purposes; and although we should prefer a more thorough reform ourselves, we shall heartily welcome such a change as a first step in the right direction. We shall soon learn that the public does not care so much about hall-marks as some would make us believe; and the system will then die a slow but natural death.

The shopkeepers and the public, as well as the trade, are now well aware that the abolition of the duty is only a matter of time; consequently, stocks are kept as low as possible, and large customers postpone their purchases. No wonder that the trade keeps on in its downward career in such a state of uncertainty! We warn our silversmiths that this downhill movement will continue until we have shaken off the duty, and it is therefore of the highest importance that it should be done with the least possible delay. The agitation will now proceed with renewed vigour, and every member of the trade should do his best to further it. A new era will begin for the silver trade, an era of progress and prosperity, as soon as this most unjust and impolitic of taxes is struck off the statute book. Not only the silversmith, but the whole nation will be benefited by the abolition of the duty; the silver-trade, under the healthy stimulus of freedom and competition, will be enabled to absorb the surplus of silver now in the market, and which, by drepreciating the value of the silver currency, has proved so disastrous to Indian finance. A recovery of the Indian rupee would follow the withdrawal of large quantities of silver for industrial purposes, and India would profit thereby to the tune of millions sterling. It really seems absurd that a duty, forming a mere trifle of our revenue, should have been allowed to crush the life out of an industry of such importance, an industry capable of increasing the natural sources of the national income by an amount many times in excess of the sum which now flows into the exchequer from this suicidal tax. It is certainly a striking example of the "penny wise and pound foolish" policy.

OUR LITERATURE.

IT seems strange that the country which has given birth to some of the most ingenious and skilful horologists, the source of many of the most important inventions and improvements in time-keeping, and the home of that most perfect of time measurers, the chronometer, should have such a poor horological literature. Besides a few treatises on special subjects, Reid's work was the only one till now which English watchmakers, without a knowledge of French or German, could consult; but excellent as that work was at the period of its publication, the change and progress of the last decades have rendered almost all but its theory obsolete. It is true there is also a vast amount of valuable instruction embodied in our periodical literature, especially in our venerable contemporary the *Horological Journal.* This information is however scattered over about twenty-five volumes, and in its present form inaccessible to most. Can nobody be found to collect and arrange these hidden gems for us? Such a work would be of immense value to the trade, and form a creditable addition to our horological literature. There are gentlemen in Clerkenwell well versed in the contents of the volumes alluded to, quite capable to deal with them, and very fond of scribbling. We point out a task which will usefully and profitably employ their ability and energy. It is no matter for surprise that with such a total absence of anything like a reliable instructor and guide, the English watchmaker should hail with delight the announcement made about two years ago, that the celebrated *Traité d'Horlogerie Moderne*, by Claudius Saunier, was about to be translated into English. We have had occasion to speak of the original and the translation of this work in previous issues of our journal in terms of unqualified praise, and we need only add that the English edition is now complete and that the good opinion we formed of it during the course of its publication has been sustained to the end. Most of our readers have been wise enough to make a slight sacrifice and possess themselves of the advantages thus offered; and from the many grateful acknowledgments of the services rendered by the translators, which have been made to us personally, we may judge that the work has given general satisfaction.

With Saunier's treatise on the shelf we have at once a horological library, as it embraces every branch of watch and clockmaking. It is methodically arranged to facilitate reference, and is provided with the most elaborate of indexes, a matter of great importance in such an extensive book.

We know that the treatise has already done good service, and we venture to predict that in the future it will prove no mean auxiliary in the difficult but *absolutely necessary* task of giving our growing-up watchmakers a more thorough knowledge of the craft. A work like Saunier's, the records of a life-long and successful apprenticeship, must become a powerful technical educator, and it only requires supplementing by the practical teacher of the indispensable manipulative skill.

In congratulating Messrs. Tripplin and Rigg on the successful completion of their difficult and laborious task, we may assure them that they have secured the gratitude and the best wishes of the trade.

An American paper quotes a couplet by Benjamin Franklin, as illustrating the advances made of late years in the art of "getting on." Franklin wrote:—

> "He that by the plough would thrive,
> Himself must either hold or drive."

The Yankee version, adapted to the times, is:—

> "He that by his trade would rise,
> Must either bust or advertise."

HINTS TO REPAIRERS.

(*Continued from page* 116.)

A STUDENT of horology can find no better model for the elementary studies of his business than one of these clocks; although when we look from a high standpoint in some instances the workmanship of these clocks is open to criticism. Still, the *construction* of the whole machine is the best that has yet been designed for reliable time-keeping. The solid construction of all its parts, and the regular geometrical proportion of the wheels, so far as their numbers and revolutions are concerned, and above all the seconds pendulum, and the long fall given to the weights, combine qualities which, notwithstanding the rude execution we may sometimes meet with, give better results than any other class of clocks made for household purposes.

Very few of the younger portion of the present generation of watchmakers, wherever they may have served their apprenticeship, have had sufficient opportunities afforded them to learn to repair one of these clocks thoroughly. In fact, of the many who undertake the repair of these clocks, we know very few who thoroughly and conscientiously repair and restore them to their original condition, and study to retain as much of the old parts as is possible, for, when the clocks are relics, their owners generally desire this to be scrupulously attended to. To those lacking the necessary experience, we propose to give a few hints on repairing this class of clock.

If the clock be very old, it is very likely that the repairs necessary to restore it to its original condition will be very heavy; because it is characteristic of these clocks, that if made in a manner only moderately accurate, and set going under conditions moderately favourable, when once set going they will run themselves almost to pieces before they stop. The pivot holes, the pivots, and the pinions, and the pallets, will all be found to be badly cut and worn. It is but seldom a new pivot will require to be introduced, because, as a general thing, the pivots were all left thick enough originally to allow them to be reduced and polished when worn; but should a new pivot be necessary, either from the effects of wear, or from being broken accidentally, there are none of the pinions in a clock but what will admit of a new one being inserted. If the new pivot has to be put at the end of the arbor where the pinion head is, it will be best not to soften the pinion; but if at the other end, a small part of the arbor may be softened with impunity. If you have not a lathe with a chuck that will take hold of the pinion, to centre and bore the hole for the new pivot, you may centre it with a hollow drill, or in a ruder method by using a common drill or a centre punch, always trying if the arbor and its pinion be true. Before you commence to bore, try it in a pair of turns, with sharp centres, and alter the centre of the new pivot hole till it be true; but care must be taken in this rude method—which must only be resorted to when no other means can be used—not to take anything from the shoulder of the old pivot, because too much end-shake to the pinion will be the result. After the pinion is centred, if it cannot be bored in the lathe, catch a split collet on it, and turn it round with the drill-bow, with the drill stationary in the vice. Bore the hole well up, and clean the oil and chips of steel out of it thoroughly, and fit in the steel that is to make the new pivot. Fit it very carefully, and in such a manner that when put in its place one tap from a light hammer will send it home, and be tight enough for every purpose. If fitted too tight, the arbor will be liable to be split; and if too loose, it will not hold; therefore the necessity for fitting it with care in the first instance will be apparent. Should an arbor happen to get split, there is no other remedy but to put on a collar or ring over the split part, or solder the pivot in, but do not solder a pivot unless as a last resource; and when you solder it, be sure always to dip the soldered part in oil before it cools, to prevent rust from breaking out. The piece of steel being fastened in its place, from which the new pivot is to be formed, the rest of the operation will be comparatively easy. Centre it in such a manner that the pinion, or its arbor, will run exactly true, then turn the new pivot to the desired size, polish it smooth, and round off the centre.

In clockwork, when pivot holes are wide, never attempt to close them with punches. The frames are usually so thick that a solid hole cannot be made all the way through if they are punched. We have seen old clocks that had the pivot holes closed by making deep marks with a centre punch all round the hole in order to close it. This kind of treatment is "botching" in its worst form, and under no circumstances should it be resorted to. If a pivot hole be so wide that a smaller one is desirable, the object will be accomplished more satisfactorily, and a naturally expert workman will do the work about as rapid, by putting in a new bush. The best way to proceed is to make the old pivot hole three or four times larger than its original size, being careful to have it a straight and round hole, widest towards the outside of the frames, and the edges of the holes carefully indented with a small round file. The hole is now ready to receive the bush, which should be made encentric, so as to admit of its being turned round to that position that will make the depth between the wheel and pinion most accurate. An encentric bush can be made with ease and great rapidity in any lathe that has a chuck that will hold a piece of wire. Catch the wire, which ought to be tough brass wire, in the chuck, and turn it to fit the hole already made in the frame; then set it a little out of truth, just as much as the bush is desired to be encentric, by tapping it with a hammer, or otherwise; next, centre the bush, as it runs in its new condition, with a graver, and bore up a hole of the desired size; now cut off the newly made bush by turning the end of it just a little longer than the thickness of the frame, undercutting it a little at the same time; afterwards, open up the hole with a broach till it fits tight on to its pivot, and put the new bush in its place and the necessary wheels into their places, and turn round the bush till the depth be right. The bush may now be riveted, and if fitted well, and not left to project too far above the level of the frame, a few taps of the hammer will tighten it, and the whole operation may be done in less time than it takes to write these directions. After riveting, the hole must again be broached out to give the necessary freedom to the pivot; and afterwards, the hole polished with a round broach, the new bush properly countersunk, so as to retain the oil, and the frame polished where the bush was inserted with bluestone, and afterwards with rottenstone and oil on a woollen cloth.

(*To be continued.*)

Truck System in the Coventry Watch Trade.—A correspondent of the *Coventry Herald* again calls attention to the abominable truck system. He says that it is still rampant, and even on the increase in several parts of the town, much to the detriment of all legitimate manufacturers. The question naturally arises, How do the men dispose of the watches they are obliged to accept in lieu of cash payments? We feel sure they cannot place them in the usual way or at a value corresponding with their original cost; the *forcing* of watches on a market where no demand exists must certainly depreciate their value; and it is, therefore, obvious enough that manufacturers, men and shopkeepers, must suffer from this practice. A heavy fine is attached to such illegitimate transactions, and it is certainly in the interest of the honest section of the trade to secure a conviction as a deterring example.

BRONZES.

By C. D. E. Fortnum, F.S.A.

(Continued from page 72.)

LYSISTRATUS, Lysippus' brother, is said to have first adopted the ill-conceived method of taking casts from the living model, and executing these in bronze. By some writers an iconic head in the British Museum, the details of which are finished with great accuracy (No. 12, case E, bronze room), is supposed to be by this artist. Chares of Lindus was a follower of Lysippus, and was the author of the world-wide celebrated colossus of Rhodes, an island particularly devoted to the worship of the sun. That huge creation, one of the seven wonders of the world, was of bronze, and represented the god Helios or Sol; it stood 105 feet in height and was completed in the year 291 B.C. It spanned the entrance of the port, ships sailing beneath the outstretched legs. Pliny states that few could span the thumbs with their arms, and that each of the fingers was larger than many statues. A winding internal stair led to the top, whence the shores of Syria and ships on the coast of Egypt could be seen. Overthrown by an earthquake, 224 B.C., it lay in ruins until Rhodes was taken by the Saracens in A.D. 672, when the fragments, 720,900 lbs. in weight of bronze, were sold, and are said to have required nine hundred camels for their transport.

The well-known bronze figure in the Capitoline museum, a seated youth extracting a thorn from the left foot, is probably a work or the copy of an original of this age (about 290-285 B. C.). The fine bronze of a drunken faun in the museum at Naples may be another example, and the grand head of Homer in the same collection.

The period of the highest development of Grecian sculpture may be said to have passed away with the death of Alexander. Then, although it still existed in a condition of excellence which has known no subsequent equal, the summit of its glory had been reached, and the easy downward path encouraged the already growing tendency to a subjective treatment and laxity of purpose, accompanied by somewhat of exaggeration in the action and voluptuous rendering of the female figure. A sense of sufficiency in the artist, almost of a boastful display of energy, becomes apparent, and the simplicity of the earlier art is lost. The purely Hellenic civilization had degenerated, and its nervous tension unstrung, by the growing influence of custom, luxury, and despotism. Nevertheless, there was a vitality in Grecian art which did not succumb without a struggle against the inevitable contagion of decay; the heart and trunk were almost dead, but some of the limbs yet retained vigour; and it was this fading and spasmodic power that produced works which were the despair of Michael Angelo, who dared not venture to restore more than a few lost extremities. Some of the works most highly esteemed by tho artists and connoisseurs of the renaissance and of our own time were produced at this period. The Rhodian arm exhibited the strongest vitality; the spirit of Lysippus still floated in the sunlit atmosphere which bathed the hundred colossi of that island. Enormous wealth drew to her foreign artists from many other schools, while it gave full employment to her own in the gorgeous decoration of stately public and private buildings. The name of Aristaonidas is given to him who executed a portrait statue of the repentant Athamas in bronzo, to which iron was said to have been added to express the glow of shame in the colour, a statement probably more poetical than correct. The mixture of some salt of iron may, however, have been used by the artist in colouring the surface of the bronze with a view to this effect. The superb marble group of the Laocoon, the admiration of Pliny and the glory of the Vatican collection, is one only of the many original works produced at this period and at Rhodes. The Farnese bull is another grand work which has been ascribed to the same time and school, as also probably the group of the wrestlers in the tribune of the Uffozii at Florence. We can refer to no typical works in bronze of this school. Among the leading artists were Agesander, Athenodorus, and Polydorus, the authors of the Laocoon; Apollonius and Fauriscus, who sculptured the Farnese bull. At Pergamus another school existed, in which the conquests of Attalus and Eumenes against the Gallic tribes which had invaded Greece about 280 B.C. were recorded, in gratitude to the gods, by large groups figurative of the battles of gods and giants; and by the representation of figures of their northern enemies, for the most part in thesame tragic and effective sensational manner as the works of the Rhodian sculptors. A tendency to represent historical subjects and dramatic action became manifest. About this period, and under this sentiment and influence, the bronze original of one of the most celebrated and admired works of ancient art which time has bequeathed to us was executed, the Apollo of the Belvedere. An antique bronze statuette (with the supporting tree-stem), in the possession of Count Stroganoff (which was found in a cavern at Saramythia, in the neighbourhood of Zoannina, in 1798, with other bronzes, three of which are in the British Museum), shows that the left hand held the ægis and not a bow, as was assumed in the restoration of the Vatican marble; this marble, beautiful as it is, can only be a copy of Hadrianic time from the bronze original.

(To be continued.)

CORRESPONDENCE.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

March 25th, 1880.

Dear Sir,—In reply to many inquiries I am glad to be able to state, through the widespread medium of your journal, that the destructive *fire* which occurred on my premises on the morning of the 2nd inst., and which in a very brief space of time entirely consumed or rendered useless for sale upwards of £2,000 worth of valuable Jet Ornaments, etc., has not interfered with the execution of orders, or the usual prompt attention to repairs. My workshop was entirely separate from tho stock and show rooms, and thus escaped damage. I would take this opportunity of thanking my numerous friends and customers for the sympathy they have shown me during this trial (augmented by severe domestic afflictions), and to assure them that my future endeavours will ever be used to give that satisfaction and prompt attention to their favours that has hitherto been a leading feature of my business.—I am, Sir, yours faithfully,

F. R. Winterburn.

Wholesale Jet Ornament Manufactory,
14, Silver-street, Whitby.

QUERIES AND ANSWERS.

Salesman.—Messrs. Jaques, Dublin, and McCreery, Belfast, manufacturers of bog-oak jewellery, will supply what you require in that line. For vulcanite jewellery we can recommend you the Hanover Vulcanite Company, 36, Basinghall Street, London, E.C.

Country Watchmaker would feel obliged for information about protecting stones and pearls in rings during the process of soldering.—[We have found that stones have ample protection from a thick paste of whiting and water. The same paste will also serve to protect enamel, chasing or engraving. —Ed.]

FINISHING AND LACQUERING THE BRASS SURFACES OF TIMEKEEPERS, ETC.

(*Continued from page* 86.)

In certain instances a fine scraper can be used very advantageously in polishing. In circular work the planishing tool is a familiar example. These tools, whether they are intended for flat, round, or hollow surfaces, should be ground with a perfectly square cutting edge; that is to say, they should not be ground to an angle, like common tuning tools, as they are sometimes ground, because when they are square they cut much sooner. The cutting edge should be of the smoothest and finest description; because it communicates, in a great measure, the same quality to the surfaces of the work smoothed with it. Small, short, or hollow circular surfaces can be finished in a good lathe by this method quicker and better than by any other method whatever. The same principle is also applied to very thin, flat surfaces. A piece of hard sheet steel, having a square and smooth cutting edge, is better adapted for this purpose than the three-cornered scraper ordinarily used, and it can also be used with good effect where surfaces are large in many instances previous to using the polishing stone.

After the surfaces have been smoothed with a polishing stone, all that is necessary to be done is to make the grain of the polish straight, and for small work this can be done best by using emery sticks of fine emery paper, pasted on to flat pieces of wood, and two or three rubs is all that is necessary to make the surface ready for lacquering. The general use of emery paper wrapped round a file is a slovenly and wasteful manner of using the paper. One sheet of paper cut up into strips and pasted on to smooth strips of wood, will do ten times more work than when it is used wrapped round a file, and it will do flat work much better. Emery sticks are made by mixing glue with emery, and spreading it on flat strips of wood, but it is more convenient to use emery paper, and instead of gluing the paper on to the wood to fasten it on with ordinary beeswax. The beeswax holds it firm enough for use, while it admits of its being easily removed when it becomes necessary to put on a fresh piece of emery paper. The paper may be spread on to the stick very conveniently and smoothly by pressing it over a smooth roller, or a piece of brass tube revolving in a frame, or even rolling the roller on a flat clean bench, will do. The emery sticks should be used dry, with no oil put on them, as in this kind of work oil has a tendency to cloud the polish. On very large surfaces, such as large clock frames, dials, etc., emery paper pasted on wood will not be found suitable, and the emery paper should be wrapped tightly round a large piece of flat cork, the work being first prepared in such a manner that only a very little rubbing with the emery paper will be necessary. Those who have been in the habit of using oil on emery paper for the last finish, we would ask them to try the very finest quality of paper without oil, and notice the difference it will make in the smoothness and regularity of the finish, and the quickness with which the work is accomplished, over the method of using oil. As a general rule, the polish left by emery paper, employed as above, represents the best surface for lacquering; but it has sometimes a pleasing effect to polish the thin edges or hollows in certain classes of work very bright. The practice of spotting surfaces is never resorted to in fine work, but it is very convenient, and has a pleasing effect on surfaces which have not been evenly and flatly polished, as it hides these defects. It is also a quick way of giving a pleasing appearance to cheap work, and is very suitable for work that requires to be handled a great deal, because marks or scratches do not show as readily on spotted surfaces as on plain ones. From the above remarks it will be seen that all that is necessary for preparing fine work for either pale or coloured lacquering is a skilful use of the polishing stone, or the scraper, and fine dry emery fastened on paper or wood in the manner already described.

Assuming that the lacquer has been made according to any of the methods described in this article, and that the surfaces have been prepared and cleaned, which will be no difficult matter when they have been polished by the dry method, the next step is to lay on the lacquer; but before laying it on, a cup must be provided to contain a little of the lacquer when it is poured out of the bottle. A piece of wire should be fastened acooss the centre of the mouth of the cup, so that when we dip the brush into the lacquer we can press the brush against it, and the superfluous lacquer will drop back into the cup. The brush best adapted for ordinary lacquering is one of the smallest size generally used by painters in laying on varnishes. The brush should not be too long, and for most purposes it is best to be moderately stiff; at least beginners will find this kind of brush best suited for them. The work to be lacquered should first be heated by means of an alcohol lamp, or a gas-stove, to about a blood heat, and brushed over with alcohol or very thin lacquer. This causes the following coatings of lacquer to flow more easily and spread more readily over the surface of the work. The work should then be heated again to such a degree that it can be touched with the back of the hand without causing pain, and then the brush applied to it and covered with a coating of lacquer. Circular work is the easiest for beginners to practice on. This work, whether it is revolved in a lathe or between the finger and thumb, should be turned slowly and the brush pressed gently against it, gradually moving it from one end of the work to the other. Heat is again applied, and the operation repeated again and again till the coating of lacquer is of the desired thickness. Whether the lacquer is intended to colour the brass or not, it should be made very thin with alcohol, andt he brass coated over with it at least half a dozen or more times, heating it between each coating to that degree of heat that the back of the hand cannot be long held in it without cuasing pain. If the metal be too hot the lacquer will be burnt, and have a rough brown appearance; and if it be too cold it will present a dull dead look. The art of obtaining the fine gloss which is so pleasing to the eye, and is an evidence that the work will wear well, is in a great measure due to the operator being able to judge of the exact quantity of heat to give the metal while being lacquered. If any of the coatings of lacquer are burnt, or if they are put on unevenly, the lacquer must all be rubbed off the work by means of a cloth and alcohol, and the operation commenced anew. Common lacquering is generally accomplished by one or two strokes of the brush, but good lacquering, designed to stand for a length of time is but a slow process, and requires much patience.

(*To be continued.*)

ANTI-OXIDE.

Messrs. B. H. Joseph and Co., of 20, Frederick Street, Birmingham, have sent us a sample bottle of a liquid termed "Anti-Oxide" which, after several practical applications, we may declare to be one of the greatest boons the jewellery trade ever received. It removes tarnish from coloured gold and silver goods almost instantaneously, restoring to either the bloom they receive from the colouring pot or the battery. A bottleful, the price of which is one shilling, is sufficient to clean a silversmith's stock.

WATCH TRIALS IN AMERICA.

YALE COLLEGE, New Haven, we learn from an American contemporary, has recently increased its usefulness by the establishment of a Bureau of Horology and a Bureau of Thermometry, to be conducted in connection with the Winchester Observatory, of which Professor Layman is the head. The object of the Horological Bureau is two-fold—to furnish standard time of rigorous exactness to the trade and the public, and to foster the manufacture of high class timekeepers by providing the means for rating watches, clocks, and chronometers.

The Waltham Watch Company is entering several hundred watches for trial, and they will be rated under the following conditions:—

Dial up.—Twelve days at ordinary temperatures; one day in the refrigerator; one day in the oven.

Dial vertical.—Fourteen days pendant up; two days pendant right; two days pendant left.

Dial down.—Two days.

Dial up.—Eight days.

The temperature of the refrigerator is 40° F., and that of the oven 90°. If the daily variation of rate with "dial up" and "pendant up" is not more than 2 seconds per day, or in changing from "dial up" to "dial vertical" is not more than 10 seconds, or for 10° change of temperature is not more than 3 seconds, a certificate will be issued of the first class.

Four classes of certificates will be issued. No. 1 certificate to the mean daily rate; mean variation; variation for 1° Fahrenheit; difference before and after oven and refrigerator; difference between pendant up and dial up; difference between pendant up and pendant right; difference between pendant up and pendant left; difference between dial up and dial down; difference between first and last week; difference between the extremes of rate. This certificate is for the higher grades of watches, and the other certificates correspond to the tests to which the watches are subjected.

The Horological Bureau is well equipped. It is provided with a transit telescope of 4-inch aperture, presented to the college by Dr. William Hillhouse, and of a high degree of optical excellence. A sidereal clock by Bond and Sons, of Boston, said to be such a perfect timekeeper that the curve representing its daily rate and variation is found to correspond very closely with the curve of barometric pressure. It is proposed to enclose this clock in an air-tight case in which an air-pump would maintain a partial vacuum, corresponding, say, to a barometer of 28 inches, thus freeing the pendulum from atmospheric disturbance. The Bureau possesses also a mean-time clock from Howard and Co., of Boston; a second sidereal clock lent by Dr. Hillhouse; a Clark chronograph for watch comparisons; a Bond chronograph for observatory work, and a large collection of telegraphic apparatus, much of it especially designed for this work by Mr. Waldo, late manager of the Cambridge time service, and now in charge of the Bureau at Yale College.

Sham Gems.—It is not of the experiments of scientific chemists that the public need beware in the matter of artifical gems, but of the cunning workmen of Paris, Brussels, and the purlieus of Soho, London. It is not pretended that any serious frauds are perpetrated by aid of the well-known "strass" or "paste" diamonds, a recognised article of commerce in this as in the last century, and worn, even by day, by many vain persons in apparent unconsciousness that their harmless deception is easily detected in sunlight by the naked eye. Sham rubies and emeralds made of "strass," coloured with purple of cassius or oxide of copper, and sapphires owing their hue to oxide of cobalt, are also not apt to deceive any but the most unpractised eye; so the lapidary who works "with intent to deceive" makes him a "doublet" or "triplet," the latter being considered the highest form of his peculiar art. The "triplet" is in fact a sandwich stone, of which the outer slices are made of rock crystal and the middle piece of coloured glass or composition. The emerald or sapphire thus constructed is of fine colour, and, when mounted, likely to impose upon all but experts. In mounting his sham sapphire, which may be worth from thirty to fifty shillings, the workman conceals the double join at the "girdle" of the stone, and thus presents two surfaces, both of which resist the file—the common test of precious stones among those least acquainted with them. When the sapphire is set in the middle of a ring, the too-cunning operator sets a real diamond worth four or five pounds on either side of it. Having now laid out £12 or £14 upon his venture, he betakes himself to the seaside, if it be summer time, or to a country town in winter, and, finding himself suddenly short of money, essays to dispose of his ring, which, it is unnecessary to say, was given him by his mother. He undergoes great grief at being compelled to part with such a precious relic, but has no choice, and therefore confides it to a newly-made friend—who thinks it a bargain to get a ring worth £80 for £40—or else tries his hand on that more difficult personage, the country pawnbroker, who, seeing the diamonds to be real and having tested the sapphire, is now and then taken in by the reduced foreign gentleman, the exile in temporary straits, or by his more flashy English confederate. Tricks of this kind have made timorous people shy of all precious stones but diamonds, which not many years ago were frequently bought as a safe and portable investment. But since the influx of African diamonds, some of which are of such fine size and quality as to sell for £3,000 or £4,000 apiece, the confidence of investors has received a rude shock, and purchases are not likely to be accelerated until the fear of the last chemical discovery has passed away.—*Daily Telegraph.*

Queen Anne Plate.—In metal work, such as the Queen Anne silver, of which so much is heard just now, the art of the forger has not extended far beyond simple casting. This, however, is apparently well enough executed to deceive that portion of the public which imagines itself to have a taste in such matters; for more Queen Anne silver has been sold during the last few years than was made in the whole reign of that proverbially defunct sovereign. The quantity of extant spoons, candlesticks, salt-cellars, and other objects supposed to have been hall-marked under Queen Anne bears, indeed, to the actual quantity produced a ludicrously similar proportion to that of the genuine vintage of champagne to the number of bottles annually drunk by confiding Englishmen, Russians, and Americans. The spoons which met with ready sale are simply castings from an old model, and, like base coin, are betrayed to the practised ear by their ring or want of ring, and to the eye by the repetition of the hall-mark, worn by friction on one side. It is quite obvious that in a number of genuine articles the hall-marks will be worn unequally and not precisely alike, as may be the case in a forged set.—*Daily News.*

Extensive Diamond Robbery at Cape Town.—Some person, supposed to have been secreted in the General Post Office building, obtained access to the registered mail bag from Kimberley, and emptied all the sealed packets of diamonds of their contents, estimated at from £30,000 to £50,000.

THE ART OF THE SILVERSMITH.

By W. Herbert Singer.*

It is now quite impossible to say at what epoch silver first came into use; we know that gold must have been in general demand towards the end of what is termed the bronze period, from the number of gold ornaments that have been found in connection with bronze implements of that time. Gold being found in a native state, was at once fit for use, but silver requiring more preparation from its ore, had probably to wait longer, until man had devised some method of working it. It is not likely, however, that silver lay hidden long after its richer sister, and, when once known, its wonderful properties as an art medium were at once appreciated, and it soon quite superseded gold for all purposes but that of personal ornament. Thus we read in the Bible of vessels of silver much more often than vessels of gold. There are no less than three hundred and five passages in Holy Writ, in which mention is made of work in the precious metals, and from these we gather abundant proof of the prodigal use of both silver and gold by the Hebrews. Space, however, will not permit me to do more than mention the many applications of precious metals which were made by the Israelites, or by those from whom we may suppose them to have learned their work, the Egyptians; nor can I, for the same reason, do more than refer, in the briefest possible manner, to the workmanship of the ancient Greeks and Romans. Homer refers to silver, but in terms which would lead us to suppose that it was then comparatively scarce. According to tradition, it was first used for coinage by Phydon, King of Ægina, about 869 B.C. We may safely conclude that, at the time of Homer, and long after, all decorative metal work, and also statues, were made by the hammer, out of thin pieces of plate, the different pieces being joined together by pins or rivets; this being long before the process of soldering was invented. Great progress was made in the modes of working metals between the age of Homer and the fifth century before Christ, the art of casting in moulds with a core being then first practised; and this new method was a most important step towards that grandeur of perfection which was hereafter gained by the people of this nation.

Three different processes were used by the Greeks in the formation and ornamentation of their silver work. The first was that of beating, by the hammer, thin plates into various forms. A thin sheet of metal was put upon a kind of cement, which yielded sufficiently to allow the requisite amount of relief; it was then worked upon with blunt punches of different shapes, the ornament or figure being gradually raised by the ground being sunk; it was, in fact, what is now termed *repoussé* work.

[The lecturer illustrated this beautiful but difficult process by six studies of a head, executed at Messrs. Singer's factory at Frome. The first showed the outline of the head faintly dotted into the metal; in the second the form is already more distinct, having been traced round with a blunt punch, by which a very slight amount of relief has been obtained; in the third, this relief is higher; and in the fourth still higher. In the latter can be seen the little punch marks which have been made in driving back the metal in some places to obtain the requisite relief for other parts—it is observable that more attention has been paid to detail in this study, as also in the fifth. The sixth study showed the work completed.—Ed.]

The second process used by the Greeks was that of engraving the surface of the work with a sharp tool, or chasing; and the third, that of inlaying one metal into another, or damascening. These different methods were often united in one work; thus a plate was first beaten up into a pattern, and was then chased with the graver. Silver was more used for such work than any other metal, and Pliny observes, as a remarkable fact, that while so many had gained renown for chasing in silver, no one was similarly famed for working in gold. It should, however, be mentioned, that soon after his time, the fashion changed, and then we find gold-chased plate most abundant.

As with the plastic art, that, perhaps, under the guidance of Phidias gained the highest point it will ever reach, so with this branch of it, which owed its perfection to the close relationship then existing between the silversmith's art and that of sculpture. The art of working in silver was, undoubtedly, in an advanced stage of progress, even in the heroic period, but it was now that it reached its complete development. The commencement of this wonderful result may have been due to Phidias himself, for some of the greatest Greek sculptors were also workers in silver.

I can only give a very rapid glance at the silverwork produced by primitive Italy. Before Rome had made herself the mistress of the world, the civilisation of the Greeks had been spreading through a great part of that country. In Sicily their influence was soon felt, and this province was famous for a long line of artists. Some parts of Italy seem to have had a civilisation even earlier than that of Greece herself. This refinement must have come from the East, but it was soon blended and absorbed in the superior culture of the Greeks. Of these nations, Etruria is especially interesting to us, for it was through her that the art of Greece first reached Rome. The jewellery of this artistic people is still the wonder of all true workmen, it being in personal ornament that they excelled. When Rome could so easily command the services of such consummate artists as these, and their Hellenic brethren, it is easily understood that so warlike a people would not delight in following the quiet and peaceful paths of art; and it was by conquest, or by these artists in their employ, that the Romans acquired most of their artistic treasure.

With the decline of the political power of the Romans, sank also their artistic power. There are many causes which brought about this end. The love of change which is ever so fatal to pure art, was one great reason. The nobles were satiated with beautiful forms, and longed for something fresh. The artists, therefore, had to create new and vicious shapes; this led them further and further from the noble paths of yore. It must also have been difficult to follow the old traditions, when work was brought into Rome from almost every country of the world, and the style of each in its turn was the whim of the hour.

The gradual decline that now commenced was but the beginning of the end, when almost all was swept away by the barbarians as they crowded victoriously into Rome, to take that terrible revenge for which they had so long thirsted. But before this took place the Romans lived on in the most prodigal splendour, their luxury being such that one cannot even comprehend it. Gold and silver glittered everywhere, and were used to such an extent that these precious metals almost passed out of the hands of the silversmiths and became a material for the builder.

(*To be continued.*)

Turner's Cement.—Melt 1 lb. of resin in a pan over the fire, and, when melted, add a ¼ of a pound of pitch. While these are boiling, add brick-dust until, by dropping a little on a cold stone, you think it hard enough. In winter it may be necessary to add a little tallow. By means of this cement a piece of wood may be fastened to the chuck, which will hold when cool; and when the work is finished it may be removed by a smart stroke with the tool. Any traces of the cement may be removed from the work by means of benzine.

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* A Paper read at the Society of Arts.

TECHNICAL EDUCATION.

APPRENTICESHIP: SCIENTIFIC AND UNSCIENTIFIC.

By Silvanus Phillips Thompson, D.Sc., B.A.,

(*Continued from page* 121.)

THOSE general principles may, I think, be laid down without much difficulty: what difficulty exists will be found rather in the application of those principles than in their abstract enunciation.

Firstly, in learning to perform any handicraft operation, or to use skilfully any tool or appliance, it is evident that the ability to do that one thing rapidly and well can only be acquired by practice; and that the beginner must learn by doing the thing many times over, slowly and carefully at first, rapidly and well afterwards.

Secondly, where, as in the case of most skilled (and in many so-called unskilled) industries, the craftsman must know how to do a great many things, or to use many different tools, it is evident that the process of acquiring the complete knowledge of the craft will be much facilitated if the learner be not kept doing over again that which he already knows how to do rapidly and well. Having gained skill in one operation by doing it often enough to acquire speed and precision, he ought at once to set about mastering the difficulties of some other operation. If he is kept for months or years doing over again and again that which he already knows how to do rapidly and well, employed as a cheap machine simply to put money into his master's pocket, he is losing just so much time of his apprenticeship.

Thirdly, all practical operations which have thus to be learned by repetition ought to be presented to the young apprentice in a graduated order best suited to his growing powers; the easy first, the harder as he gains power and knowledge. There is in every craft an order in which the round of skilled operations are best learned, an order not to be hastily settled, but known only to those who have themselves been trained and have had to train others, and is clearly an order in the course of which the learning to do one thing shall best prepare the way for the learning to do the next. The round of manual acquirements ought to be rationally and systematically arranged.

Fourthly, no apprentice should be allowed to do anything without being shown or told how to do it. It is a point of the utmost importance that the young workman should never be allowed to work unintelligently; the habit of unintelligent working once acquired is hardly ever thrown off. The prevailing idea in this country seems to be that a man ought to learn how to do a thing by simply doing it; whereas the *rational plan is to ascertain first how it should be done, and then to do it.* There is always a best way of doing a thing, known only to men of intelligent practical experience. No work should be attempted by a beginner until the method and *rationale* of it has been explained to him. He will thus be saved from trying bad and useless methods, and will be called upon to use his reasoning faculties. There can be no question that theoretical knowledge may thus be of great service in saving a workman's time. This constitutes, indeed, the main difference in many trades between the practical training of English and Continental workmen. One is supposed to learn simply by doing the thing over and over again, blindly and unintelligently; the other is supposed to learn by first learning how the thing ought to be done, and then doing it.

Fifthly, instruction in the general principles of science, which underlie almost all handicraft trades, ought to be taught systematically to the apprentice by teachers who understand what they are teaching, and who also are acquainted with the practical details of the applications of those principles to the particular trade followed by the apprentice, so that they may be able to point out continually the agreements and the apparent discrepancies between abstract theory and the actual methods of practice dictated by experience.

Sixthly, instruction in manual exercise ought to begin early. The dexterity of hand, the quick perception of the eye, are not to be attained after a certain age. In many skilled crafts this age is indeed very early. Musicians know how early the child must begin to practice whose fingers are to acquire a perfect training, and there are many industries requiring a skill of hand little short of that which the violin player or pianist must possess.

Seventhly, throughout the period of apprenticeship, but particularly in its early stages, the manual exercises set to the apprentice should be chosen solely because they will improve his growing capacities; the idea of making him do paying work ought to be set aside. The thought should be, not what will pay now, but what will pay twenty years hence. Therefore, every other consideration should be subordinated to the desire to improve the skill of the apprentice.

Eighthly, to give breadth and generality to the practical knowledge of the apprentice, he should, in the early stages of his training, see something of various kinds of work; there being undoubted advantages in a carpenter, for example, and a smith knowing something of each other's work. Too early a specialisation cramps the powers alike of the hand and of the eye.

Having thus laid down the general principles of a rational apprenticeship, I think if we once more consider the method of training a lad which is in vogue in the generality of the British workshops, we shall see that it violates almost every one of those fundamental propositions. It is very seldom that the foreman or journeyman of the workshop can be found who will set systematic exercises to the young beginner, insisting that he shall learn to do one thing at once with precision and speed, and then proceed without delay to the next. Still less often will such a one instruct the beginner in the *rationale* of each operation, showing him how and why the thing can theoretically be best done, or instilling into him the general principles of science as applied to his trade. And when we ask where the workshop exists in which the work given to the young apprentice is chosen solely with the view of assisting him, and not because it is a paying job, we ask in vain. Our medical students must spend weeks and months in dissection and other exercises, solely for their own good. Musicians must practice scales and exercises which bring no pay to the performer. Art students must draw and model from the antique, studies on which they can never realise a penny; and pharmacists must go through a course of chemistry, and analyse very unprofitable decoctions, solely to gain skill. But neither the carpenter, the smith, the mechanician, the watchmaker, or the printer, is put through a course of practical studies solely to promote his skill. To make bad worse, the time at which the training the hand and eye must be acquired is postponed often till too late, by forcing the future craftsman to remain till he is thirteen or fourteen at a school in which the studies that would best help him on in the future find little place, and in which, again, he is being taught, not so much for his own improvement or advancement as for this—that his schoolmaster may gain a payment upon the brilliant feat of cramming him to pass a school examination.

Is there any place, then—any workshop, factory, or institution—where anything approaching a rational and scientific apprenticeship exists? Is there any trade, art, craft, or profession, the apprenticeship of which can be regarded in any sense as rational or adequate? Outside the limits of the so-called professions, I know of none in England, unless we except the pharmacists. Thanks to the determination of the leading pharmacists of England, it is now almost impossible for a youth to obtain an employment as a dispenser of drugs without having spent some months in a pharmaceutical school or college, in addition to the years of practical experience which he must serve in the trade, the degree of his attainments being tested by sundry examinations, worked on an unusually judicious and satisfactory system. But in the handicrafts and mechanical trades there is nothing approaching even this imperfect step towards a technical training, and certainly nothing resembling the systematical industrial training of certain schools abroad.

This brings me to a point of some importance, namely, the line which is advantageously but arbitrarily drawn between technical education, strictly so called, and industrial education. This distinction was laid down in 1868, by a committee of the Society of Arts, who in their report defined technical education to be "general instruction in those sciences the principles of which are applicable to various employments in life," with the express limitation that "for the purposes of discussion, technical education should be deemed to exclude the manual instruction in arts and manufactures which is given in the workshop." No authoritative writer on the subject has since given any definition which differs very materially from the above, and as the distinction thereby drawn is unquestionably useful, the definition must, I think, be accepted. Nevertheless, I am not quite sure of the wisdom of thus drawing an arbitrary distinction, since technical education is of little avail to any person who has not received an industrial training also; and no industrial training is worth the name unless it is also to a large extent technical, that is, unless the teaching of manual aptitudes be preceded, accompanied, and followed by theoretical instruction.

Having drawn attention to this point, I propose now to turn to some of those continental institutions in which it appears to me the principles laid down as those underlying a rational and scientific apprenticeship may be seen in operation.

We are probably all aware of the innumerable and splendid technical schools and colleges which exist in Germany, Switzerland, France, Austria, Belgium, and even in Russia. I will name as types of them the *Polytechnikums* of Dresden, Stuttgardt, Berlin, and Zürich, the three *Ecoles des Arts et Métiers* of Aix, Angers, and Châlons, and *Ecole Centrale des Arts et Manufactures* of Paris. These institutions do not profess to teach any trade or industry, except engineering, which in some of them is a special feature; they are colleges for applied science to which educated persons may resort to add to their technical knowledge. Hence, while admirable for giving to foremen, masters, and the professed teachers of applied science, the higher technical training those persons need, they do nothing directly for apprenticeship. Indirectly, however, they do a great deal in their respective countries for apprenticeship in the mechanical trades, inasmuch as they provide what in England we have no recognised means of providing—trained men as heads of workshops; men who are superior to rules of thumb, and who have some notion how to train the young beginners placed under their charge.

There are also in Germany, Switzerland, and France a number of other institutions, partly technical and partly industrial in character. Such are the technical high schools of Hanover and of Chemnitz, and many of the superior *Gewerbe-Schulen*, *Fortbildungs-Schulen*, and *Handels-Fortbildungs-Schulen* of Germany. Such are the weaving schools of Chemnitz and of Crefeld; not to speak of the schools of dyeing, carpentry, forestry, and building which are found in various parts of Germany and Switzerland. Many of these are industrial, in the sense that they teach thoroughly and systematically the manual processes required in various arts and trades; but they are all of them, also, technical, in that principles are always taught as the guide of practice. They are places where a learner must learn how to do a thing before he does it, and when he is set to do it in the best possible manner. Be it observed, however, that very few of these provide a training which is intended to obviate the necessity of going through a regular course of work in a workshop. They are rather supplementary to such work. In the case of German schools, it must be remembered that these technical institutions are working parts of a harmonious scheme of education, which, beginning in the elementary schools, parts off the pupils on the one hand into the literary courses of the *Gymnasien*, and thence to the University, or, on the other, into the more modern *Real-Schulen* and *Gewerbe-Schulen*, the best pupils passing thence to the *Polytechnikum* or Technical College, or else directly into trade and commerce.

In France, a somewhat similar arrangement drafts off the literary pupils to the *Lycées*, and provides for those who are going into commercial or industrial life, the great modern schools, such as the *Ecole Turgot* and the *College Chaptal*. There are, moreover, the two great military schools, *St. Cyr* and the *Ecole Polytechnique*, a special school of architecture, and the four great engineering schools already named.

But there are also in France a number of lesser institutions specially designed to aid in the education of the apprentice, and though they are mostly isolated, of comparatively recent growth, and very diverse in organisation, they are of such capital importance, in respect of our present subject, that I must beg to speak in some detail concerning them. They are either schools in which the experiment is being tried of giving a rational apprenticeship in workshops, apart from the necessities or caprices of a trading concern, or they are factories in which, under the direction of enlightened men of business, the experiment is being tried of giving to the apprentices of the firm a rational and systematic course of instruction.

(*To be continued.*)

The latest notion of young gentlemen is to discard the albert chain, and to wear their watches in a fob with a chain and seals, after the fashion of our grandfathers.

The yield of Victorian gold for 1879 is estimated at 715,009 oz.; a decrease of 38,784 oz. on the previous year. During the past year the Melbourne mint coined 2,740,000 sovereigns.

Mr. Streeter has on view at his establishment in Bond-street an extraordinary piece of carbon from Brazil, which, it is stated, is the largest ever found in any part of the world, the weight being nearly 800 carats. The specimen will be purchased, it is understood, for the collection of one of the scientific institutions.

Faraday's Cap Cement.—Electrical Cement.—Resin, 5 ozs.; beeswax, 1 oz.; red ochre or Venetian red in powder, 1 oz. Dry the earth thoroughly on a stove at a temperature above 212°. Melt the wax and resin together, and stir in the powder by degrees. Stir until cold, lest the earthy matter settle to the bottom. Used for fastening brass work to glass tubes, flasks, etc.

City and Guilds of London Institute.—A letter was recently addressed by Lord Selborne, F.R.S. (Chairman of the Council), and Mr. F. I. Bramwell, F.R.S. (Chairman of the Executive Committee), to the Prince of Wales, as president of her Majesty's Commissioners for the Exhibition of 1851, in which proposals were made for building a Central Institution or College for Advanced Technical Education, at a cost of £50,000 and upwards, on a plot of land fronting the Exhibition-road, South Kensington, and for maintaining the same fully fitted and equipped with all suitable appliances at an annual charge of at least £5,000 per annum over and above the amount of fees received. It is now announced that the Executive Committee of the Commissioners of 1851 are prepared to recommend the acceptance of these proposals made on behalf of the City and Guilds of London Institute.

WHITE NICKEL BRONZE.

THE pure white tint of nickel, its inoxidisability, and therefore the ease with which it is kept clean, have caused it to come into general use for metal fittings, especially those of vessels and carriages, as well as for the bright parts of engines and machines. But, on account of the relatively high price hitherto obtained by nickel, it has been employed chiefly in the state of electro-deposit.

Nickel-plating is effected by two processes, one hot and the other cold. In the former, a solution of sulphate of nickel is used in an enamel cast-iron trough. This is the more rapid method, but its result is not so satisfactory as in the cold process. The latter is effected with a bath of double sulphate of nickel and ammonia, the articles to be nickelised being suspended by a platinum wire attached to the positive pole of the battery, while a plate of pure nickel, to restore the metal to the bath, is put in connection with the negative pole. The nickelisation thus produced, though it requires a longer time than the other process, is finer and more durable.

There are, however, several objections to nickel-plating. The process is injurious to the workmen engaged in it. The thin coating of nickel is liable to peel off, and in the case of parts exposed to wear, or even with cleaning, in course of time, the nickel becomes so worn off at the edges as to expose the base metal beneath. Besides, nickelisation does not entirely prevent the oxidisation of steel and iron.

A French company, La Société Française Anonyme de Nickel, briefly referred to in connection with the Applied Science Exhibition, Paris, are endeavouring to supersede the nickelisation of brass and copper by the use of solid nickel bronze, which is thus obtained. The ore, *garnierite*, extensive deposits of which exist in New Caledonia, the French penal settlement, is worked by Messrs. John Higginson and Co., of Nouméa, the *concessionnaires*. It is by them subjected to a roasting or preliminary fusion, which forms a regulus, containing from 60 to 70 per cent. of metallic nickel. This substance is shipped to the works of the French company at Septèmes, near Marseilles, where it is smelted into ingots and granules containing $99\frac{1}{2}$ per cent. of pure nickel and $\frac{1}{4}$ per cent. of utilisable metallic substances. The extent of the mineral deposits in New Caledonia, the reduction in the cost of freight owing to the concentration of metal through the preliminary fusion, and the economy effected by the new methods of reduction devised by M. Jules Garnier, enables the company to sell the pure metal at about one-half the price it obtained three years ago.

For a long time past, efforts have been made to work nickel, but without success, until the present year, because it was found too brittle; now, however, pure nickel has been rolled and forged, cups, knives, and other articles having been formed of it. As a rule, the pure nickel is mixed by the founder with various proportions of copper, zinc, and tin, according to circumstance, to form nickel bronze; but at least 20 per cent. of nickel is required to secure inoxidisability, and to give the desired tint. All articles that are now made of brass or copper nickelised may be produced in solid white nickel bronze, by the same processes, and with the same plant, and at practically the same cost; they are also 20 per cent. stronger, so that in many cases they may be made so much lighter. The great strength and the property of non-oxidisation render this alloy eminently suitable for mathematical and musical instruments. A small quantity of nickel added to steel increases its hardness, and renders it inoxidisable, while edge-tools made of the alloy stand better than those of ordinary steel. A nickel bell-metal is also found to give good results. The Paris Exhibition of 1878 proved the action of a totally new system of metallurgy in connection with this beautiful metal; and that of 1879 showed its practical introduction into most branches of manufacturing industry.—*Journal of the Society of Arts.*

PNEUMATIC CLOCKS IN PARIS.

THE Municipality of Paris has contracted with the Pneumatic Clock Company for the erection of a number of clocks in the principal thoroughfares. Some of them have lately been set in motion. Each clock consists of two opaque glass dials, with a hollow space between, in which a gas burner is lit at night, so that the time can be seen by persons approaching in either direction. The hands are moved at an interval of a minute by means of pneumatic tubes, the air being pumped in by a six-horse power engine. Observatory time is, of course, given, and the company offer to lay tubes to private houses.

The system is that of the Viennese Pneumatic Clock Company, invented by Mr. Mayrhofer, and patented by Messrs. Victor Popp and Ernest Resch, also of Vienna. In our Journal of May, 1878, we gave a full description of this system, with illustrated supplement, representing all the arrangements at the central depot of this company at Vienna.

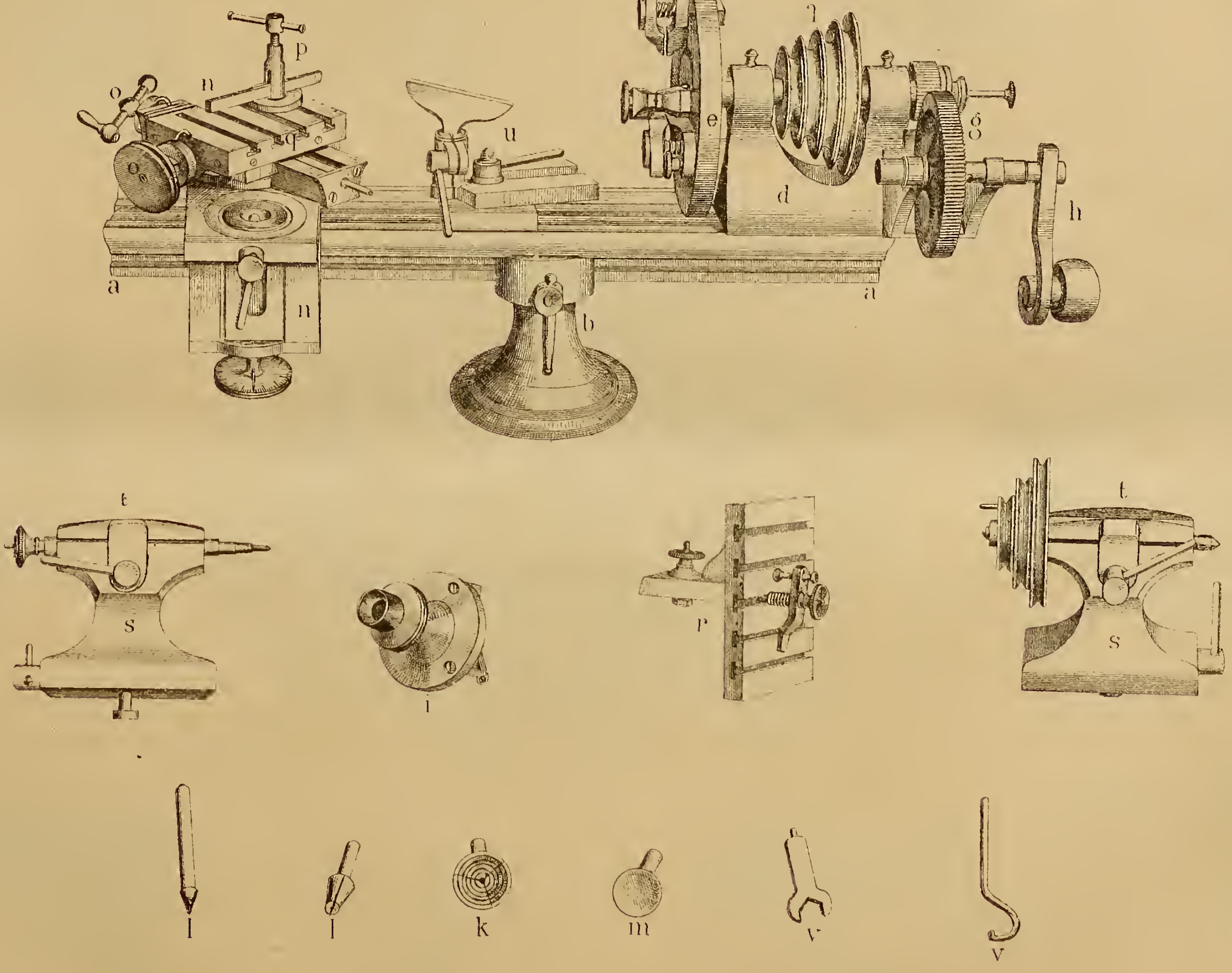
Caution.—Small keyless watches, crystal glasses, floral decoration engraved on back, stamped inside both cases in a garter "Warranted gold, 18k," are being largely offered and £2 each asked. They are nothing but brass.—*Pawnbrokers' Gazette.*

Gutta Percha Cement.—This highly recommended cement is made by melting together, in an iron pan, two parts common pitch and one part gutta percha, stirring them well together until thoroughly incorporated, and then pouring the liquid into cold water. When cold it is black, solid, and elastic; but it softens with heat, and at 100° F. is a thin fluid. It may be used as a soft paste, or in the liquid state, and answers an excellent purpose in cementing metal, glass, porcelain, ivory, etc. It may be used instead of putty for glazing windows.

Novel Mode of Preserving a Man's Reason.—A curious story is going the rounds of the English newspapers of an exhibition in the show windows of one of the leading jewellers of Vienna. The object of attraction is a brooch magnificently studded with gems, in the middle of whose chasing is inclosed the most singular of centres—four common, old, bent and corroded pins. This brooch is the property of the Countess Lavetskofy. The pins have a history, of course. Seven years ago Count Robert Lavetskofy, as the story runs, was arrested at Warsaw for an alleged insult to the Russian Government. The real author of the insult, which consisted of some careless words spoken at a social gathering, was his wife. He accepted the accusation, however, and was sent to prison.

In one of the lightless dungeons in which the Czar is said to be fond of confining his Polish subjects, the unfortunate martyr for his wife's loose tongue spent six years. He had only one amusement. After he had been searched and thrown into a cell, he had found in his coat four pins. These he pulled out and threw on the floor, then in the darkness he hunted for them. Having found then, perhaps after hours and even days, he scattered them again. And so the game went on for six weary years. "But for them," he writes in his memoirs, "I would have gone mad. They provided me with a purpose. So long as I had them to search for, I had something to do. When the decree for my liberation as an exile was brought to me, the jailer found me on my knees hunting for one which had escaped me for two days. They saved my wife's husband from lunacy. My wife, therefore, could not desire a prouder ornament."

Tour multiple. (Système J. H. Perrenoud).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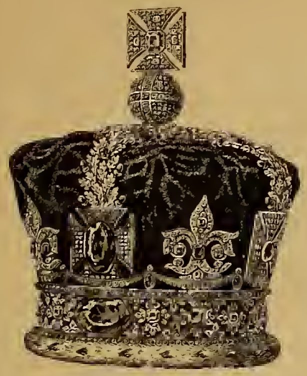
Supplement to the Watchmaker, Jeweller and Silversmith.



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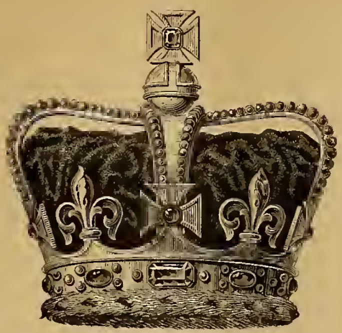

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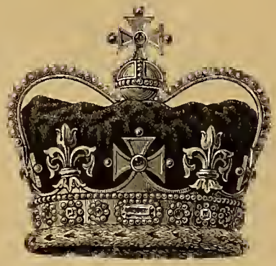

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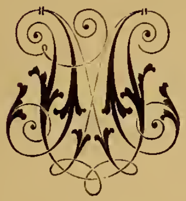

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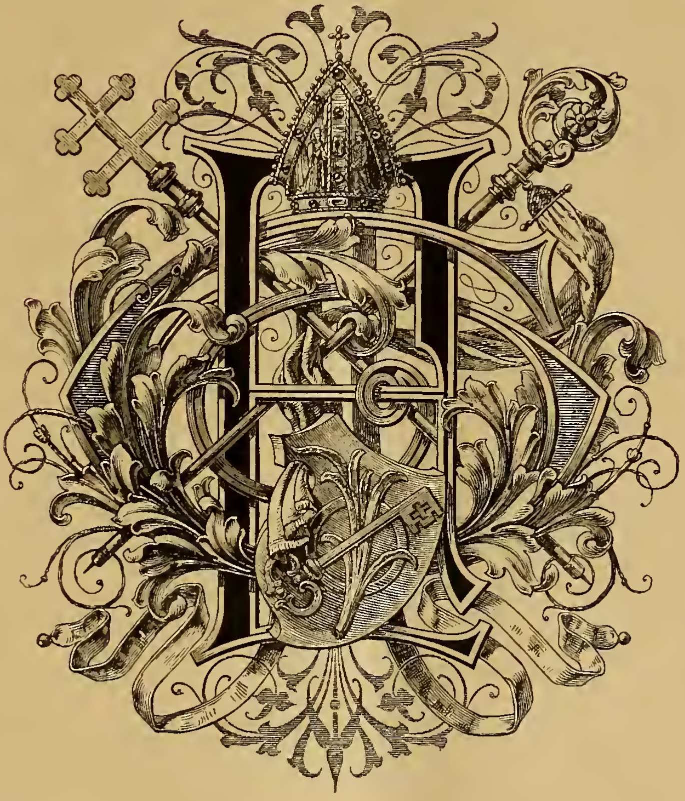

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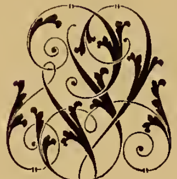

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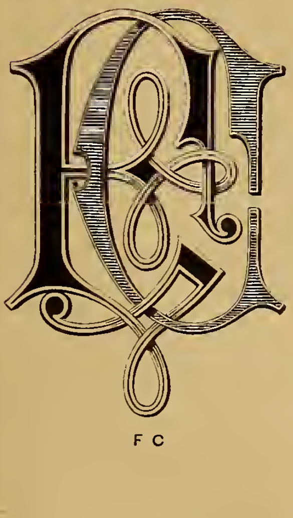

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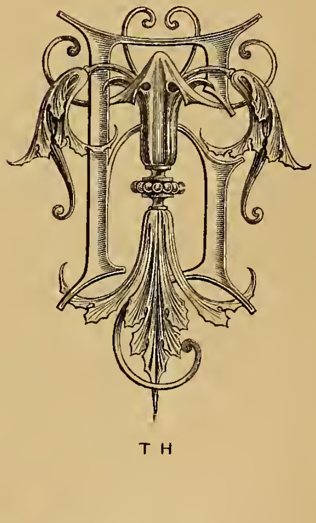

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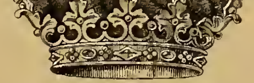
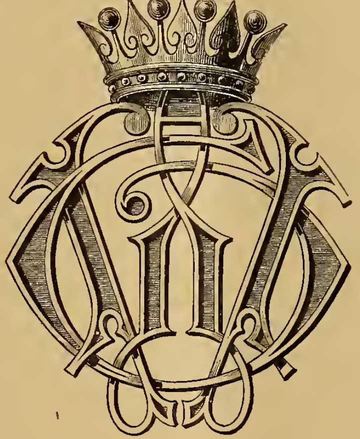


GERMAN ROYAL CROWN.



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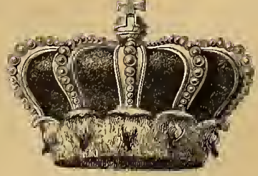

GERMAN ELECTORAL CROWN.

EXAMPLES of MONOGRAMS and CROWNS DESIGNED and EXECUTED by Messrs. MARTIN GERLACH & CO., of VIENNA.

THE WATCHMAKER JEWELLER AND SILVERSMITH'S TRADE JOURNAL.

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

Entered at Stationers' Hall.—Registered for Transmission Abroad.

CONTENTS.

	PAGE
The Construction of a Simple but Mechanically Perfect Watch	137
The Pocket Rating of Watches	138
Practical Instructions to Jewellers, Silversmiths and Electro-platers	139
Clockmakers' Company's Prizes	139
The Silver Trade with the Colonies	140
"Multiple" Lathe	140
Hints to Repairers	141
The New French Tariff	141
Monograms	142
Finishing and Lacquering the Brass Surfaces of Timekeepers, etc.	143
Bronzes	143
The Present System of the English Watch Manufacture	144
Technical Education	147
Patents	i
Monthly Record of Bankruptcies	ii
Directory	iv
Advertisements	i—xii

No. 60.—Vol. V.] MAY 5, 1880. [Subscription, 5s. per Annum. Post Free.

THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.*

By M. Grossmann, Watch Manufacturer, Glashuette (Saxony).

(*Continued from page* 126.)

18. There is no absolute mechanical necessity for giving a certain thickness to the plates of the frames, but the pillar plate ought to be sufficiently thick to afford a safe hold for good strong screws, and to contain the pallet and escape wheel so as to be a trifle below the surface of the plate. The upper plate ought to contain the centre wheel in its countersink flush with the inner surface of the plate, and, besides, a solid bearing for the upper pivot of the centre pinion should be left. To satisfy these requirements it will be found advantageous to make the pillar plate of a three-quarter-plate or skeleton movement, 0.06 of its diameter. The upper plate ought to be about 0.035 of the same diameter. These proportions apply, of course, only to watches of a mean height (say 0.16, or about one-sixth of their diameter); a flat watch, having a weaker main-spring, and consequently less strain on the frame, and less pressure on the centre pinion, can bear a reduction of these thicknesses.

19. The material of which the frame is to be made is also worthy of consideration. A certain degree of elasticity and hardness are required for the purpose; besides, it ought to offer the least frictional resistance to the movement of the pivots, and oppose the greatest durability to the wear resulting from this motion.

20. For this last reason steel is out of question here; besides, it could not possibly be protected against rusting, and magnetism might endanger the rate of such a watch in a most serious way. Still, I will remark here that I had an opportunity of observing for many years a good watch, constructed by a German maker before jewel holes were at convenient reach. To obtain greater durability he had screwed steel bushings into the plates for all the pivots, the escapement included, and these steel holes, well hardened and polished, showed almost no wear at all after more than fifty years' performance, and kept the oil remarkably well.

21. Brass fully answers all the requirements of a good watch frame if its greatest hardness and density is imparted to it by sufficient rolling or hammering. Hammering is preferable to rolling, because the latter process stretches the metal, an effect which does anything but improve the quality of the material. Small rollers stretch the material more than large ones. I have made a series of rather tedious experiments in order to find out the best way of obtaining the greatest possible density of brass. For this purpose I con-

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structed a small tilt hammer of about three pounds weight, striking five to six blows in a second, and adjustable to perfect parallelism with its anvil. I found that a strip of brass worked with it did not show the slightest increase in breadth and length—a proof that the considerable amount of mechanical work bestowed upon it had acted exclusively in the right direction. By comparison, I found a strip of one millim. thickness reduced to 0·9 millim. through this vertical hammering, and it was equal in elasticity to a strip of 3 millim.* reduced by rolling to the same thickness, but which became extended by the process to 2½ times its former length. Thus it is clearly seen that the work done by the rollers is chiefly expended in spreading the metal, and that only a small portion of it serves to increase its density—the real object in view. This stretching process is a source of great injury to the solidity of the metal; it not only produces fissures at the edges of the strips, but it also increases the size of the smallest defects (flaws or holes) in the metal, while vertical compression rather helps to reduce them. I could not continue my experiments on a larger scale, because the little tilt hammer was the maximum of what a man can drive with a foot wheel, and I had no machine power at my disposal; but the result obtained led me to the conclusion that the method generally used for attaining the necessary density and elasticity of brass is altogether wrong. I should prefer to stamp out the rough plates and other parts with punch and die from the common hard rolled sheet brass to be bought in any shop, allowing about 10 per cent. extra thickness for reduction by hammering. Each part ought then to be put on a flat anvil and submitted to the powerful blow of a falling block, adjusted exactly parallel to the face of the anvil. Such a method would offer the further advantage of making both faces of the blank piece quite smooth and level, so that not so much need be taken from it as when prepared in the ordinary way. For manufacturing on a large scale, it would perhaps be more advantageous to operate with a press, as we see them in the mint. If we consider the perfection with which medals and coins are stamped, it is permissible to conclude that a similar machine could turn out a pillar plate with its sunk part and the shoulder for the casing, and that in such a perfect form that would render even stoning superfluous.

22. The plates of English watches are, as a rule, very soft, owing to the bad practice of the gilders to expose them to a high degree of heat. The reason for such a proceeding is unknown to me, but it requires no proof that a very good gilding can be effected without heating at all. The upper plates, too, are generally too thin, and especially with the screwed jewels, the screw heads of which are sunk into the plate, they give a good deal of trouble to the repairers, owing to the very small amount of stock left for the screw threads in that soft metal.

23. For some years there has been an increasing demand for the so-called *nickel movements*. These are made of *German silver*, and that incorrect denomination is derived from nickel, one of the chief constituents of this alloy. There can be no doubt that German silver is a first-rate material for watch-work, from its elasticity and hardness, and those desirous of going deeper into the subject I refer to the particulars of my experiments published in my "Essay on the Detached Lever Escapement," chapter xiv. A nicely polished and grained German silver movement is certainly a handsome looking article, and its surface resists remarkably well all atmospheric influences, while brass needs to be protected by gilding. Still, when touched in a careless way with perspiring hands, very ugly black stains are the result, and in this particular it is inferior to gilt brass.

In all other points, German silver offers no advantage over brass, and it must be said that it is very injurious to the eyes of those who have constantly to work at finishing those brightly polished movements. Brass, at any rate, if well prepared, is so nearly equal in physical qualities to German silver, that the demand for the latter as a material for watch movements may be considered a mere matter of taste. It must be mentioned here that German silver is, to a certain degree, susceptible of magnetism, a circumstance not at all favourable in a material used for the construction of the frame of horological machines. It appears, also, that the threads of screws in German silver will not last as well as in brass, if due care is not taken to grease the screws a little at each repairing of the watch; this has led to the employment of coarser screws (deep cut and wide thread) for the better class of these movements.

In many nickel movements the spring hook in the barrel and even the barrel cover are of brass, a fact from which we may conclude that German silver has been found wanting in these points.

(*To be continued.*)

THE POCKET RATING OF WATCHES.

MANY watchmakers have long felt the difficulty and trouble of rating on the bench the finer class of instruments sufficiently near for pocket satisfaction. Under the maker's eye they have given good results; but, after being transferred to the pocket of the customer the going has been so different that unpleasant calls have had to be made for the purpose of being "regulated." Such calls are disagreeable to both maker and wearer, and are attempted to be got over by the maker carrying the watch a few days or so himself, and doing the best that can be done in that way, either by his own regulator or the Post Office clock, according to the place where he may be established.

In order to remedy such a defective condition of this kind, it is intended to open, in connection with this journal, a department that has for several years been privately tried in a limited way with much success. That is, that watches will be received, worn in the pocket, and otherwise subjected to regular work, as if the customers had them. They will be in the pocket on railways, omnibuses, cabs, walking, &c., about fifteen hours a day. They will be rated by the time wire of the Greenwich Observatory standard clock, and a mean weekly rate of performance will be kept and supplied at the termination of the trial to the owner. The rating-paper will be signed by the gentleman conducting that department, and it may be published or not, at the discretion of the owner. It is to be clearly understood that the "regulation" of the watch will under no circumstances be meddled with unless at the desire of the maker, but in that event he may rely upon its being done by a competent hand. The period during which the rating will be carried on will vary from one to two months as the watch may happen to steady itself to its work. As only a limited number can thus be on trial, makers are requested to bear this in mind, and send types of classes of their manufacture. In special cases, where a watch is wanted for immediate wear, it will be specially attended to. A moderate fee will be charged, which may be learnt on application to the Editor.

TASMANIA is revising its tariff. Plate and plate ware, gold and silver of every description, now subject to a duty of 1s. per oz., will be charged 12½ per cent. ad valorem under the new tariff.

ENGRAVING MACHINE.—A late American invention is a machine for engraving metals and carving designs upon wood and ornaments of all kinds. It is said to do the work of 15 men in the most rapid, workmanlike, and artistic manner.

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* In future we shall abbreviate the word "millimeter" by "m."

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. XIII.

(*Continued from page* 127.)

THE objects to be coppered are suspended in the bath by copper wires, supported themselves upon a stout clean brass rod, the two extremities of which rest upon the brass conducting wire fixed upon the tank. Several of such rods are placed parallel to each other, and great care must be taken to prevent any contact with the anode, because the working of the bath would then be immediately stopped. When the thickness of the deposited copper is very small, the coat is sufficiently bright to be considered finished after drying; but if the operation is more protracted the deposit has a more or less dead lustre on account of its thickness, and if a bright lustre is desired we must use the scratch-brush. The hot baths are put into stoneware vessels heated in a water or steam bath, or into an enamelled cast iron kettle placed directly over a fire. The insides are also lined with an anode of copper connected with the positive pole of the battery, and the edges of the vessels are varnished, or support a wooden ring upon which rests a brass circle communicating with the negative pole; the objects to be treated hang from this circle. The hot process is much more rapid than the cold, and is especially adapted to those articles which are difficult to cleanse, because any remaining greasy substance is dissolved by the alkaline bath. Parcels of small articles, metallic pens for instance, are not suspended in the bath; they should be connected with the negative wire in the hand of the operator, and stirred about in every direction in the bath. This agitation permits of the employment of an intense current without danger to the beauty of the deposit. Small articles of zinc are placed in a stoneware perforated ladle, at the bottom of which is attached a zinc or copper wire which is wound up around the handle, and is connected with the negative pole of the battery. It is sufficient that one of the small articles touches the wire for all of the others to be affected by the current, as they are in contact with each other. If the bottom of the bath is metallic, it is necessary to prevent its coming into contact with any parts of the objects which might get through the holes of the ladle, and this is done by resting the ladle on a porcelain or stoneware ring; a preserving pot without a bottom will answer well. During the operation the articles are often jerked in the ladle; this agitation changes the position and the points of contact of the objects. Where the deposit is being made too slowly, bring up the bath by the addition of equal weights of acetate of copper and cyanide of potassium.

To Copper Silver.—Large pieces of silverware are coppered in one of these baths. Very small articles are simply threaded upon a zinc or iron wire, or placed in a perforated ladle with granules or cuttings of either of these metals. Place the whole for a few minutes in a weak but very acid solution of sulphate of copper. The zinc or the iron dissolves and takes the place of the copper, which is deposited upon the silver. When the article is intended to be gilded or silvered, it is immediately passed through the solution of nitrate of binoxide of mercury, rinsed in cold water, and placed in the electro-baths, without drying or scratch-brushing.

Brassing.—This operation has a most extensive application, as an immense quantity and variety of articles made of iron or zinc are subjected to it to give them the appearance of brass. Manufactures of bronze composition, such as lamps, candelabra, clocks, statuettes, &c., made of zinc or other cheap alloys, are also first covered with brass, as the bronzing is more easily and successfully performed upon brass deposits. Another advantage derived from this method is, that if any part of the surface is removed a beautiful yellow colour will show itself beneath, as if the whole of the metal was real brass or bronze.

The preliminary and finishing processes in brassing are exactly the same as for coppering; the disposition of the baths and apparatus are also similar according to the objects under treatment. The formulæ are, however, different. Brassing is seldom done hot, although it is preferred for certain applications. Coils of iron or zinc wire, for instance, are plated with brass by heat. The proper temperature varies from 130° to 140° F., and the coils of wire dip only one-half or two-thirds of their diameter into the bath. The bath is put into an oblong open iron boiler heated by fire, steam, or hot water. The inside is lined with brass sheets connected with the positive pole of a battery. A stout copper or brass rod, in the direction of the length of the boiler, rests upon the edges, and the contact of the two metals is prevented by pieces of india-rubber tubing. The rod is connected with the negative pole by a binding screw. Remove the binding wire from the coils, and loosen the wires, bending the ends together into a loop. Dip the wire in a pickle of diluted sulphuric acid, and hang it on a strong round peg fixed in the wall, so that the coil can be made to rotate easily. After a scrubbing with wet, sharp sand and a hard brush, give the coil a primary deposit of pure copper. It is then suspended to the horizontal rod over the brass bath, where only a part of the coil at a time dips into the solution and receives the deposit. The coil must be turned now and then one-half or one-fourth of its circumference: by dipping the coil entirely into the liquid, the operation is not so successful. The wires are washed, dried in saw-dust, and then in a stove, and lastly passed through a draw-plate to give them the fine polish of true brass wire. Copper and brass wires are also covered with brass electro-deposits, in order to give them various shades.

(*To be continued.*)

CLOCKMAKERS' COMPANY'S PRIZES.

THE court of assistants of this company, to encourage the highest excellence in the production of the marine chronometer, have determined to award annually two prizes to the makers of the two chronometers which shall perform with the greatest accuracy, under the conditions prescribed by the Astronomer Royal, at the annual trials at the Royal Observatory, Greenwich.

First prize:—Ten guineas, and the Freedom of the Company.

Second prize:—Five guineas.

The rules for regulating the competition, and further information may be obtained on application to Mr. H. C. Overall, *clerk to the company*, Guildhall, E.C.

Ivory.—Owing to an increasing demand and diminished supply, the price of ivory has considerably advanced. Sheffield alone is said to consume £100,000 worth annually, and America is now also a large buyer. A contemporary advises the public, when buying articles professing to be ivory, malachite, amber, pink coral, tortoiseshell, &c., to beware that celluloid is not palmed upon them at the price of the genuine article. When celluloid was first introduced billiard balls of that material were pledged with pawnbrokers as genuine ivory balls, and the fraud was not detected until a large quantity of them had been placed.

THE SILVER TRADE WITH THE COLONIES.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

SIR,—It will be in the recollection of your readers that some months ago I addressed "a warning" to manufacturers that Americans were certain to compete but too successfully with them in our Australian colonies. I pointed out that, with a view to the Sydney Exhibition, travellers from New York had already been sent to Australia, and that before I left America large orders for silver ware were being received by manufacturers. I felt certain from what I then saw of American productions that directly a footing was obtained our trade with the colonies would practically cease. From advices which I have lately received from Australia, it is found that my surmises were but too correct. In a letter from a personal friend in the colony occurs the following:—

"We are all much delighted with American silver ware, particularly with that exhibited by the Gorham Company, of Providence. It has real merit. The general excellence of design is supplemented by the most careful finish as respects the workmanship, and the general impression of the people in these parts is that, in future, American silver ware will be preferred to English. Indeed, one shopkeeper here has a window devoted to the display of American silver ware, and his stock of English plate is being offered at a heavy loss.

"I cannot but think that English manufacturers are far behind their American rivals, notably in tea and coffee services, the designs of which have long struck me as being hopelessly bad, the workmanship being coarse and unfinished. I hear that you are trying to do away with the duty, and to abolish the system of compulsory hall-marking. Buyers here care nothing about hall-marking. Of course I do not understand the question, but I am strongly of impression that there is something wrong in your trade. The improvements in other English productions are so marked that the logical inference is that silversmiths, whose goods show a falling off in quality, must be under some depressive influence. You will do well to proceed with your agitation; some good must result from it. At all events your manufacturers should know that there is no chance of orders coming from these latitudes, American silver ware has fairly beaten them out of the field."

Now, sir, there can be no doubt about the fact. If our manufacturers desire to compete with America, they must turn over a new leaf. They must dismiss from their minds the fallacy that the quality of the material is the only consideration of a buyer,—that the hall-mark will, in the future, cover sins in design and execution. It will do no such thing. Public taste is rapidly improving. The eye is accustomed to designs of great excellence as respects glass, porcelain, and brass, not to speak of furniture, house decoration, and jewellery. In point of fact all trades, with one exception, have improved; the exception is that of the silversmith. He will not have to look far for the cause of his failure. It is to be found in the hindrances by which he is surrounded. There are other influences at work, I know, foremost among them being the desire of shopkeepers to have "weight" for their money. However, shopkeepers can be educated to a better state of things; it rests with manufacturers to walk with the times. I am convinced that the first step to be taken is to obtain perfect freedom of trade. The duty, of course, must be abolished, hall-marking must be made a voluntary institution to die out gradually of inanition, and the connection with the Goldsmiths' Company at present prevailing must be severed.

I have the honour to be,
Sir,
Your obedient Servant,
EDWARD J. WATHERSTON.

Pall Mall East, London.
May 1st.

"MULTIPLE" LATHE.

WITH the present issue will be found a Supplement illustrating a new lathe and its accessories, invented and constructed by Mr. J. H. Perrenoud, of Cortaillod, Switzerland, and which will be exhibited at the International Exhibition of Watch-tools, etc., at Geneva. A full description will appear in our next.

A NOVEL watch chain is formed by links representing together a complete express train.

CAUTION.—Gold albert chains, fetter link pattern, stamped 15c. on each link, and weighing about 1½ oz., have been pledged in several towns in the Midland Counties, by a man of gentlemanly appearance, about 45, with black whiskers. They are only 7 or 8 carat. He usually asks £4 10s., but leaves them for £3.—*Pawnbrokers' Gazette.*

THE FRENCH CROWN JEWELS.—Some time ago there was some talk about selling the magnificent collection of diamonds forming part of the French Crown Jewels, valued at 40,000,000 francs. Loth to disperse a collection of such artistic value, yet anxious to conciliate those Republicans who wish the crown to be sold because they do not want anyone to wear it, the government have decided upon the following course. The crown diamonds will be divided into three classes:—1. The heraldic ones, having some artistic or historical interest. These will be deposited in the Apollo Gallery of the Louvre, and among them the famous Regent. 2. The diamonds having a special mineralogical value will be sent to the Museum of Natural History. 3. Those which may be considered mere jewellery, and of which the value is estimated at 3,000,000 francs, will be sold for the benefit of the museum funds.

BRITISH SILVER PLATE.—"A London Silversmith," referring to the late *exposé* and wholesale seizure of plate, with its accompanying fine of £6,500 by the Goldsmiths' Company, hopes it will give a substantial check to the "old silver plate mania," and increase the demand for the production of art workmen of to-day. "It must be clear to everyone," says our correspondent, "that trade marks, which would be jealously guarded by their owners, would prove essentially a more secure guarantee to the purchaser of silver plate than the hall mark, which is so imperfectly protected by the Goldsmiths' Company. It would be indisputably the interest of owners of trade marks to make goods up to the standard they profess to sell, without which no reputation could ever be built up. Dealers at sales would seek out goods bearing known trade marks, and buy accordingly; therefore possessors of silver plate would never have cause to fear the hammer of the auctioneer. The forgery of a trade mark is rigorously punished, the penalty attached to such forgeries is so severe that the temptation to cheat is virtually removed. It may be confidently expected that, whoever may be the future Chancellor of the Exchequer, he will not fail to see how utterly impossible it is for the trade to become prosperous until the industry is unfettered, and how paltry is the sum which the tax produces in comparison to what the revenue would otherwise obtain."—*Daily Telegraph.*

HINTS TO REPAIRERS.

(*Continued from page* 129.)

If the leaves of the pinions are badly cut, there is no use filing the marks out, because if the pinion has been right at first, filing will make them too thin, and the pitching will be bad any way you can set it, and it is better to shift the action of the wheels that work into them. This is easiest accomplished by turning the necessary quantity off the shoulder of one of the pivots, and putting in a *raised* bush to fit the pivot at the opposite end. By this method two actions can often be shifted by one alteration, and it is always better than disturbing the wheels or their arbors, which in old clocks are usually fastened to collets soldered with hard solder.

Sometimes it happens that a leaf gets broken out of a pinion, which is a serious matter when it is desirable that the old pinion be retained. In this class of clocks, where small solid pinions of seven and eight leaves are used, there is no other way of saving the pinion except by fastening two rings near to the pinion-head, and to these rings fasten a new leaf to take the place of the broken one. In the case of the centre and third pinions, where the wheel is rivetted on to the pinion-head, it will only be necessary to fasten one ring to hold a new leaf, because the wheel itself can be used to take the place of the other ring.

In the very oldest clocks we seldom see much wear on the teeth of the wheels if the depths have been right when the clock was new. Sometimes a tooth, or a few teeth, get broken by accident, and these can be easily replaced in most instances. When a tooth or teeth have to be replaced, the most desirable method is to dovetail a piece of brass into the rim of the wheel, of the requisite size, and fasten it by soft solder that will flow at a moderate heat. We must confess that soldering, in the present instance, is better than riveting, because in riveting, an inexperienced person, and also the most experienced one in some instances, will stretch the wheel and put it out of round, whereas soldering, if a moderate heat be used, is entirely harmless; and if care has been taken to fit the brass exactly to the dovetail, the solder will not show much when the sides are polished off. The tooth or teeth may now be formed in the new brass that has been inserted in the wheel, and if done agreeable to the above instructions the wheel for all practical purposes will be equally as good as when new. Sometimes, when a tooth or teeth are broken, small holes are drilled in the edge of the wheel and pins driven in to take the place of teeth. This plan is very good as a temporary method, and we have ourselves practised it in temporarily repairing a clock when it could not at the time be removed to a workshop; but although proper under such circumstances, it is not to be commended as an example to follow when a clock has been removed to a workshop for thorough repair.

In repairing the escapement, probably in some instances there will be a difficulty in retaining all the original parts. If the escapement has been in action for a long time without oil, the points of the teeth of the scape-wheel may be worn. In most cases the wheel can be restored and rendered as good as new by putting it in the lathe and topping the teeth with a smooth file or a graver till they are all of equal length, and then dress them up with files to the proper shape; but should the wheel have any inequalities in the division of the teeth, there is no use troubling with it. Make up your mind to put in a new one at once, for this part of the clock cannot be saved and do justice to the other parts. A new wheel can be made very easily by any person who has a cutting-engine and understands how to use it. The pallets will be sure to be badly cut, because invariably they are the first part of these clocks to wear out. Still, if they are recoiling pallets, in most instances they can be repaired if judiciously managed. First soften if they be hard, and file out the marks that have been worn in them. Then close the pallets by bending them till they closely embrace the number of teeth they originally did. This is done with the greatest safety by placing them between the jaws of a vice and closing the vice gently. It will be noticed that by this method of closing pallets the part nearest the movable jaw of the vice will bend first; so, after closing them a little, it will be well to reverse the pallets in the vice, that they may be closed evenly. We consider this method of bending to be better than that of using a hammer; the strain does not come on the steel so suddenly, and we very seldom, if ever, see pallets break when closed in this manner. After the pallets have been filed and closed in the above manner, when they are placed in the frames along with the scape-wheel, it will be found that the "drop" in the perpendicular pallet will be considerable. This drop can only be reduced by altering the front pivot-hole of the pallets, or by taking the steady pins out of the back cock and moving it down, or by both methods, care being taken to steady-pin the back cock in its new position after moving it. The drop of the horizontal pallet can only be altered by bending the pallets in the manner already described. The acting faces of the pallets, if it be a recoiling escapement, should be shaped so as to produce a slight recoil or retrograde motion of the scape-wheel, after a tooth has escaped from the one pallet on to the other.

It is difficult to describe exactly the precise shape that these pallets should be. The shape is one of great importance, and if the workman is not conversant with the subject, his safest course is to notice and preserve the precise shape these acting faces were *before the pallets were bent*, and file them to the same shape afterwards. If this be carefully attended to, and the drops adjusted as we have described, the escapement will be as good as it was when the clock was new. If the escapement be a dead-beat one, and the pallets be much cut on the circular part, it will be difficult to make a good escapement and retain the old pallets; for after the marks are taken out of the acting faces they will be too thin —a certain amount of thickness being necessary. In some instances, when they are not deeply worn, they may be repaired so as to last many years. The same directions for closing the pallets and altering the drops apply to this form of pallets as well as to recoiling ones; and the inclined planes, or impulse faces, have to be filed so that the teeth of the wheel will strike just beyond the edge of the angle.

(*To be continued.*)

THE NEW FRENCH TARIFF

The proposed revised customs tariff, the result of nearly two years' labour by a specially appointed commission consisting of thirty-three members, provides for an increased import duty on watches:—

Present Tariff.	New Tariff.		
Silver watches 5 per cent. ad valorem or 1 franc each at option of importer	1	90	each.
Gold watches 5 per cent. or 3 francs and 87 cents. each at option..	4	40	do.
Watches with metal cases 5 per cent.	1	60	do.
Keyless silver watches 5 per cent. or 1 franc each	2	50	do.
Keyless gold watches 5 per cent. or 5 francs each	6	25	do.
Keyless metal case watches 5 per cent.	1	60	do.
Silver chronometers 5 per cent...	4	40	do.
Gold ditto 5 per cent.	8	75	do.
Rough watch movements 5 per cent.	1	0	do.
Ditto, keyless 5 per cent.	2	0	do.
Finished ditto 5 per cent.	3	10	do.
Ditto keyless 5 per cent...	4	60	do.

MONOGRAMS.

At a time when our plate and watches, pendants and bracelets, furniture and tapestry, glass and chinaware, and a host of other articles of personal and household use and decoration, are embellished with monograms, it needs no apology to say a few words about monogrammatic art. The word monogram is derived from *monos*, single or only, and *gramma*, meaning "a single mark," a character or cipher composed of one, two, or more letters interwoven, being a sort of abbreviation of a name. Monograms were much used in coins by the Romans, for instance, though they did not employ them on inscriptions; and were also used on standards, walls, and tapestries, seals, and documents; first on coins, latest on documents, in which they were employed not only by princes and ecclesiastical dignitaries, but also by magistrates and notaries. At the commencement of the Christian period their use was universal. The Roman *labarum* bore the monogram of Jesus Christ, which consisted of two letters, a P placed perpendicularly through the middle of an X, as we find it on many medals of the age of Constantine, these being the first two letters of the word ΧΡΙΣΤΟΣ. Under the Eastern Empire it is usual to find M J K, which forms the monogram of Mary Jesus Constantine. The use of monograms was exceedingly common upon Greek coins; and many antiquarians have bestowed much time and attention in the effort to decipher them—a useless labour, since a great number of those monograms were, without doubt, of a conventional nature, and understood only by a few, even in the times at which the coins were current. After the time of Charlemagne, who made much use of them and improved their form, monograms became very common in all the countries which had belonged to the Frankish Empire. The love of combining and contorting letters and words flourished universally in the Middle Ages, and the exercise of this art helped to while away the solitude of the monastic cells. The titles and rubrics of Greek manuscripts are frequently monogrammatic, and numerous and diversified monograms are found in Latin manuscripts. Alphabets like the Roman, of an angular character, have many letters with corresponding parts; and the upright strokes, the horizontal lines, and the curves are easily made by arranging them so that the similar portions shall coincide to produce numerous combinations. Monograms are usually combinations of more than two letters; when only two were incorporated they were generally designated ligatures. After the twelfth century they gradually went out of use. The use of them remained longest in Germany, where it was formally abolished by the Diet of Worms in 1495. The knowledge of monograms of this public kind is of great importance for the illustration of the monuments and documents of the Middle Ages, and therefore forms a particular branch of diplomatics, for they were much employed in the mediæval diplomatic art. The term was subsequently applied to all sorts of cyphers and signs with which artists, particularly painters and engravers, were accustomed to designate their works. These have often been counterfeited. The mediæval seal-engraver, to economise as much as possible the annular space available for the legend, favoured much both ligatures and monograms. Many of those seals had the initials of their owners blended and incorporated with the devices, called *merchant-marks*, corresponding somewhat to our trade marks, which were the stamp, as it were, by which the work of each artist was known.

The general considerations to be observed in monogrammatic designing is to mingle clearness and obscurity, involving and implicating the general design, while the elements are clear and obvious when unlocked by the key. The surname initial demands a special prominence, and there is no other limitation but the ingenuity and patience of the artist. Different grounding or tinting of each letter gives distinctness to the combination; but this is not always essential except to prevent confusion. The scrip letter and Gothic are still the most available for the best ideas from their curves and points and flowing lines, and yet a fancy rendering of the Roman and block letter produces some most attractive fancies.

Whoever has paid the least attention to monogrammatic art as displayed to us, say in the window of a jeweller or stationer, must have been struck by the great uniformity of the designs. This want of variety is probably due to the fact that engravers, instead of striving to obtain new designs, are satisfied with simply copying the stereotyped patterns from an old book of monograms, the designs of which are all from the same pencil, and consequently bear that strong family likeness. Under these circumstances, those who long for something new and original will be glad to learn that a magnificent collection of monograms by noted German artists is now in course of publication by Messrs. Gerlach and Co., of Vienna. To say that it is the best work ever published on the subject is doing it but little justice; the versatility of genius and artistic conception displayed in the designs and devices are astonishing, and the elegance of outline, delicacy of detail, and grace of form which characterise each deserve the highest praise.

The leading designers in Berlin and Vienna have been brought under contribution, and, as might be expected, the result has been a work which will prove an unfailing resource to the manufacturing jeweller, the engraver, and to every student of beautiful design. Every style of ornament is fully represented through all the gradations, from the most severe to the most ornate, while a harmony is everywhere traceable between the form of letter adopted and the kind of enrichment with which it is embellished. A wealth of ornamental letters has been brought together in this volume, and it is surprising to note to what a variety of graceful curvature and pleasing outline the twenty-six letters of the alphabet lend themselves. A large proportion of the monograms are mounted, so to speak, in extremely chaste escutcheons, not a whit less original in design than the letters to which they serve as a kind of background. In many cases, again, ducal and other crowns have been tastefully interwoven with the monograms, while in other instances trade and similar emblems have been made to do like service. It is impossible by mere description to convey a just idea of the choice designs figured in this treasure-house of inspiration. Whatever the style of ornament adopted, and whether the representation embodies the form of a griffin or an owl, a lion or an eagle, whether a lotus plant be figured or a bunch of fruit, whether a polygon escutcheon or intricate scroll-work, there is regard for truth, beauty and perfect finish. The sheet of illustrations which accompanies this issue gives but a faint idea of Mr. Gerlach's work.

It is a general and confusing error in all works on monograms to combine the interlacement so as to serve for two readings, thus A B is equally B A; but in the work under review this drawback has been completely obviated, and all the letters of the alphabet will be found as duplicate monograms in two combinations; for instance, in A B the A is to the left of B, or unmistakably on it, whereas in B A the B is on or in front of the A. The work contains three complete alphabets interlaced in monograms in various types and styles; a set of monograms on a larger scale, in connection with beautifully ornamented figurative and symbolic representations as centrepieces to some of the plates, specially adapted to the use of artists whose particular branches may be the designing or engraving of monograms with symbolical surroundings; a complete set of monograms, composed of an intertexture of three letters; also the English, French, and German Christian names, and symbols most frequently used, monogrammal, heraldic attributes, professional emblems, three complete initial alphabets and vignette designs for finals in German renaissance style, and lastly the crowns, as worn in the different parts of the globe, with English, French, and German text. The entire work will consist of 98 plates complete in 50 parts, 49 with illustrations, and one with text and a general and clearly arranged index. The cost, 1s. per part, is a mere trifle when the style and character of the work is taken into consideration. The agent of Messrs. Gerlach and Co., for the United Kingdom, is Mr. A. Fischer, 7, Finsbury Place, London, E.C., to whom all orders for subscriptions, etc., should be addressed.

FINISHING AND LACQUERING THE BRASS SURFACES OF TIMEKEEPERS, ETC.

(*Concluded from page* 131.)

IN lacquering flat irregular formed surfaces, such as cocks, bridges, or work of a similar nature, precisely the same directions are to be followed as in lacquering circular surfaces; but in this kind of work the great danger to be avoided is the lacquer collecting on the edges and spreading in irregular quantities. The benefits of first coating the work with alcohol, or very thin lacquer, becomes greater in this kind of work, causing the lacquer, when it is applied, to flow more easily and regular. The brush must be laid on to the work very light, and with a slight curved motion at the beginning of the stroke, so that it will miss the sharp edge of the work by which a portion of the lacquer would be pressed out and flow irregularly over the edge. The brush must then be drawn straight and with equal pressure along the surface of the brass, and lifted of at the instant it reaches the other edge. In moderately broad surfaces a brush the full breadth of the work should be used; but in very large surfaces, and especially where there are a number of large holes in the work, an ordinary brush is not suitable. The best kind of brush for this purpose is one made in the following manner:—Take a piece of wood a little broader than the work to be lacquered, and make it into the shape of an ordinary whitewash-brush handle. Then cut a slit into it lengthwise with a thick saw; next take a narrow strlp of clean flannel, as long as the wood is broad, and fold it the longest way; then take a piece of white nankeen cloth and fold it round the outside of the flannel, and put them both in the slit cut in the wood, with their folded edge outward, and fasten the cloth to the wood by means of screws passing through the side. Before fastensing tight, however, a piece of straight wire, about a quarter of an inch thick, must be put through the bow of the folded cloth, and the cloth pulled tight against the wire so as to make it smooth and straight. After the cloth is fastened tight to the wood the wire is pulled out, and it is fit to be used as a lacquer brush. The woollen cloth holds the lacquer, while the nankeen cloth prevents it from flowing too freely, and presents a smooth surface to the metal that is to be lacquered, while it also prevents any particles coming off the woollen cloth on to the lacquered surface. This kind of brush must not be dipped into a bowl of lacquer, but the lacquer put on to it by means of a common brush. In this manner large flat surfaces are lacquered very beautiful. When work is newly lacquered the lacquer is soft, and the work ought to be exposed to a gentle heat for a short time to evaporate the alcohol and harden the lacquer. Small gas cooking stoves are very suitable for this purpose, and it will be found that after newly lacquered work has been baked for a short time any little unevenness in the laying on of the lacquer will be much improved.

BRONZES.

By C. D. E. FORTNUM, F.S.A.

(*Continued from page* 130.)

THE conquest of Greece by Rome was the death-blow to all purely Grecian art as embodying the Grecian sentiment and purpose. Nevertheless, more than a mere mechanical power survived; and the removal of artists together with works of art to Rome was accompanied by a revival, during which works among the most precious that have been preserved to our days were executed. The inborn power of art, unable to expand into those higher regions of originality which the period of Grecian glory had kept free, was now given up to production rather than creation, and to the gratification of a patron rather than as a thank offering to and glorification of a god. The splendour of what has been called Roman art was the produce of enslaved Greek genius, and the soul of the ideal was equally in bonds. Nevertheless, some marvellous works in marble were executed, and among these are now some of the most noble gems of our modern museums. The Hercules torso of the Belvedere, the admiration of Michael Angelo, attributed to the Athenian Apollonius; the Farnese Hercules by Glycon, the originals of both works having been probably in bronze; the Venus de Medici, by Cleomenes of Athens; the Venus of the Capitol, the Callipyge, and the crouching Venus after Daedalus; the Pallas of the Ludorisi villa; and the portrait statue of a Roman orator, known as the Germanicus of the Louvre, by another Cleomenes; are believed to be copies of this period. We have already referred to the Apollo of the Belvedere as being a copy of this later time from an earlier bronze original, with which may also be classed the Diana of Versailles and the Ariadne of the Vatican. The pillage of Greece by Rome brought into the latter country, mainly to the capital, though also spread about among the imperial and other villas of the peninsula, a crowd of the finest works in bronze, of all periods of Grecian art; a crowd so vast as to be thought almost incredible.

Thus we learn from ancient history that Scaurus was said to have possessed 3,000 bronze statues, which Pliny tells us he used in adorning a temporary theatre. These, doubtless, formed some of the riches taken by Sylla from the luxurious cities of Asia Minor. A fine bronze vase in the Capitoline Museum, an inscription on which states it to have been given by Mithridates to the gymnasium of the Eupatorians, may have been part of the same plunder. At an even earlier period, when Syracuse was taken, the Roman conqueror Marcellus sent one-half the artistic spoils to Rome to adorn the public places and buildings. And, at the last, after all previous spoilation, some idea of the extent of the immense employment of bronze in Greece may be formed from the record that the Roman consul found 3,000 bronze statues remaining at Athens, as many at Rhodes, and an equal number at Olympia and Delphi.

Some of the most admirable portraits of Roman personages were the work of Greek artists. Such are the Spada Simpey; the Augustus of villa Livia; that also in the Vatican found at Otricoli; the bust of the young Augustus, and another equally fine in the British Museum; the Agrippina of the Capitol, and other works in marble. Thaletius, a Greek bronze caster, worked at Rome in the first century of the empire. The museum at Naples is rich in portraits, statues, and busts of bronze; many of great excellence; a few of an early period, others of Hadrianic and later time.

(*To be continued.*)

PNEUMATIC CLOCKS.—We hear that a firm in New York has purchased the right of working the patent of the Vienna Pneumatic Clock Company in the United States.

THE PRESENT SYSTEM OF THE ENGLISH WATCH MANUFACTURE.

LAST Wednesday evening Mr. Bickley, one of our leading practical watchmakers, opened a discussion under the above name at the British Horological Institute, Mr. David Glasgow, a vice-president of the Institute, in the chair. There was a full, interested attendance, both of the standard authorities and the coming men of the Clerkenwell trade; and altogether something of instructive interest contributed to make a very agreeable evening. The discussion may be said to be the complement of a lecture on "The Past, Present, and Future" of the same subject, which was given by Mr. J. U. Poole in February last. Furthermore, in the March number of the official journal of the Institute, Mr. Glasgow published a paper still further intensifying the question on account of the acknowledged high authority and position of the writer. Such was the state of the case when the meeting assembled with whetted appetites to hear Mr. Bickley. Of course, in proceedings extending over a couple of hours, we can only find room for an abstract, but quite sufficient, we trust, to enable our readers to comprehend the whole drift of the argument.

Among the more notable gentlemen present were Mr. Glasgow, the chairman, Mr. Bickley, the lecturer, Mr. Crisp, Mr. Curzon, Mr. John Jones, a vice-president, Mr. J. U. Poole, Mr. T. Wright, Mr. Nielson, Mr. Bacon, Mr. Ganney, and Mr. Britten, the secretary of the Institute.

Mr. Bickley commenced by saying that when he promised to open the discussion he had no idea of writing a paper upon it. When, however, he came to look over the matter, he saw that it required much careful thought, and that the best way would be to put what he had to say upon paper. What they had to consider was the present position of the trade, and to adopt methods to revive it. He found that some parties advocated the factory system and forty-shilling watches, whilst some went on the other side—much in the way that things had been going on. For his part he did not agree with either, but still he thought that a system might be adopted carrying with it an improvement, which he felt satisfied that forty-shilling watches would never do. [There was a general concurrence with this opinion by the meeting]. There was now a large amount of work put in the movement at a low price, but then they had to do over again what the movement-maker might have done at first (Hear, hear.) Mr. Bickley then gave some details of fusee and barrel work, which ought not to exist, and which the finisher should not be called upon to rectify. (Hear, hear.) Formerly there were great complaints about the thickness of wheels and other similar shortcomings; there had been great improvements, but there was room for much further improvements. These, if carried out, would prevent a considerable waste of time in the completion of the watch, and would also materially help to lessen the cost to the purchaser. (Hear, hear.) He did not speak in a carping spirit towards the movement-makers, but he thought that their work might be more systematically done than it was at present. (Hear, hear.) It would not be much trouble to have gauges, and then they would know more precisely what they were doing all through the making of the movement. He could give words of praise to Mr. Wycherly, of Prescot, for what he had done in the way of movement-making. (Hear, hear.) His opinion, however, was that Mr. Wycherly went too far in one direction, and not far enough in another. Movement-makers ought to send up the pinions and wheels in a much more finished way, and if they did so it would save doing some things twice over. (Hear, hear.) In following the movement it passed from the maker to the finisher and to the examiner. There was a sad want of knowledge of principles there all through, for the examiner had to do what the finisher should have done. (Hear, hear.) In old days the finisher went through all his work, and the watch was supposed to be completed when it left his hands. Now, however, although the work was divided, it was not in a corresponding degree improved. (Hear, hear.) The finisher formerly had his work divided into three parts, but it now required to be still further subdivided upon an easily understood system. Men would then have less to learn, and consequently the task would be shorter, and the learning easier.

Passing to another phase of the subject, the lecturer said that there had been a great change in watchmaking during the last fifty years. Fifty years ago a three-quarter plate watch was a rarity, but now, what a difference; not only in that, but in the watch generally. Now, Coventry had movements from Lancashire, with escapements and cases made in Clerkenwell, where the watch was brought to time and then sent down to Coventry to be sold as their best make. (Laughter.) He could not see how a Coventry man by that means could save more than a sovereign in the price of the watch, and that could not make all the difference between prosperity and stagnation. (Hear, hear.) He next referred to Mr. Poole's statement in his own lecture that "the cost of living in London is quite 25 per cent. more than in the Midland Counties." Mr. Bickley thought that such was not the case except in the matter of house-rent, perhaps. He knew of no place where, taking one thing with another, a workman could live cheaper than in London.

[A speaker from the body of the meeting called out that both coals and house-rent were much cheaper in the country than in London; coals seldom going beyond 14s. a ton.]

Mr. Bickley thought that the lower rate of house-rent was the only real difference, and went into some details on the question. He referred to times past in a humorous way, when Coventry men came up to Clerkenwell to enjoy themselves and get work by way of a change. Now it was the other way about; that is, that Clerkenwell men went to Coventry. (Laughter.)

Coming to the main question again, he thought that without going into the factory sytem with all its minuteness, an improvement in the mode of production could be brought about here. If, for instance, improvements could be made in finishing, it would greatly advance the method of manufacture. (Hear, hear.) In speaking of springing, he was sorry to see the barbarism of undersprung watches still adhered to. He had seen that in the watches of the English Watch Company of Birmingham they had adopted underspringing. They should borrow an idea from the Swiss, who had borrowed many from us, and get rid of it altogether. (Hear, hear.)

[With respect to the English Watch Company's undersprung watches, it was pointed out to them a long time ago. Their answer was, that by a re-arrangement of the parts they had been able to overcome any defect attaching to that method, and that their undersprung balances worked in perfect freedom,—as free as the oversprung, without one single objectionable feature. Indeed, if anything, they thought that their method of underspringing improved the watch.]

Mr. Bickley went on to say that polishing should be a separate branch of the trade, and so of other parts of the movements. The examiner should do his part with the movement in the grey, after which it should be sent to be gilt, when the watch ought to be looked upon as completed. (Hear, hear.) By so dividing the business, workmen would have so much less to learn, and better workmanship and cheapness of cost would follow as matters of course. (Hear, hear.) Things would not then have to be done, as they have now, twice over. With respect to jewelled escapements, he thought that through holes would be best, so that end-stones could be got rid of altogether. (Hear, hear.) He would not go into keyless work that evening, but he thought that if something like what he had sketched could be carried out the trade would be largely benefited, and he trusted that it would come about.

Mr. Bickley resumed his seat amid warm approval.

Mr. Curzon thought that levers, rollers, pallets, and wheels, might be furnished in large quantities. He had made some experiments in that direction, but he had been too busy with his other work to arrive at any definite conclusions.

Mr. Ganney said that he went down to Prescot a few weeks ago to see what work could be done in that way with the view of cheapening it. He, however, found that they were no cheaper there than in Clerkenwell. Twenty-five or thirty years ago escapements were made much cheaper than now. It was a marvel how they got a living at it. When the vertical watch was given up, a mistake was made in not having put something in its place. They make better wages at Coventry on account of the quantities given out. Large orders were given by the Birmingham houses, and that kept the Coventry workmen going. What was wanted was some individual, or some number of them, to work in that way of large orders. It had been tried in co-operation among the men some years, and answered very well as far as it went. The speaker gave some details of adapting a means to an end, and with respect to keyless work said that Mr. Hewitt, of Prescot, had made some wonderful improvements. Mr. Ehrhardt, of Birmingham, had also some very fine machinery, and may do more than anyone else to improve matters. The fact was that in Clerkenwell they had no public spirit, whereas in Coventry and Prescot they had. With public spirit they in Clerkenwell could do things just as well as they can in Prescot and Coventry. (Hear, hear.)

Mr. Jones, in referring to the question of springing, stated that he made a good many undersprung watches, and by a plan that he had adopted (which he explained) he got as much freedom in the balance from under as he did from overspringing. Another thing: he thought that underspringing was much more scientific, on account, as we understood, of the balance and spring being able to be fixed nearer to the centre of the balance-staff. The results of his method of underspringing were so good with his common work that he was ashamed of charging for the overspringing with his better class of work, as it almost looked like taking money out of people's pockets for nothing. (Laughter.) He had not been to Lancashire for many years, and when there he wondered how the men could live on the wages they earned. He thought that there should be some explanation of why foreign watches were so cheap now. His own opinion was that Clerkenwell was too much addicted to old styles. They should try and improve upon that. Only think of the numberless little contrivances in the making of a watch that have passed on from generation to generation. Each man ought, in learning and working at his trade, give as much to it in the way of skill as he can. All workmen received much from those who had gone before them, and in return for that, the successors were bound to do what they could to advance production, so as to leave it in a better way than that in which they found it. (Hear, hear.) On the other hand, he thought that workmen had too much to learn, and had not sufficient time to think about new things. Again, there was no good in producing unless the distributors can manage to get rid of the goods. (Hear, hear.) It would be well if they could get abroad, and for this reason : He was in Brussels, Paris, Turin, and Milan, and saw only one English watch in the shop windows during his journey, and that was in Paris. He was so struck by what he saw, that he went into the shop and asked the proprietor—a very polite, respectable-looking gentleman—if he knew the name of an English watch? The answer was "Yes, but there is no sale for them; nobody asks about them." Furthermore, if an English watch is shown to them, the master calls all his men around him, and they examine it all over, treating the fusee as a curiosity. (Laughter.) With respect to the greater cost of the English watch, there were some advantages for it in return. There was solidity, safety, etc. There was a position for English watchmaking, but he did not think there was one for American. He thought the Americans had no chance in the contest for cheapness with the Swiss, and gave some instances of it in the prices of Swiss watches as compared with American ones of the same quality. The Swiss commanded the market against the Americans. With respect to English watchmaking, he thought that if they degenerated into the factory system they would endanger their solidity and the high characteristics of the English watch; still, some thing was wanted to cheapen the cost of English watchmaking. He thought the American workman was nothing.

Mr. Ganney retorted that he thought the American workman was everything, and proceeded to quote prices in support of his statement. But whatever defect the American workmen had, they never made a watch that would not go. (Ironical laughter.) For ourselves, he contended that we had too much national pride. The worst fault that certain watches had in English eyes was that they looked a little "Swissy." But Swiss watches were always in the hands of repairers, and if they so continued we should soon have all the repairing trade. He then went into an account of co-operation having being tried among the men some years ago, because the retailers would not be satisfied with less than cent. per cent. profit, and wanted their own names as the makers on the watches into the bargain! Co-operation in private was tried after that, but the men had to give it up for fear that if the masters found it out they would all be sent to starvation. Still it was working very well in Coventry at present. He next turned to dial work, and said that thousands upon thousands of dials were sent over to America to be got up, because they could be done cheaper there than in Clerkenwell. In America factories were started to make money. The starters were no horologists, and they did not care whether the watch went round the sun, or the sun round the watch, so that it paid. (Laughter.) If there was a large capital on co-operative principles, there were plenty of men waiting to bring their wives, sisters, and cousins into the trade; plenty.

Mr. Glasgow said that Mr. Ganney went wide of the mark if he wanted to benefit the trade with quarrels between workmen and masters.

Mr. T. Wright spoke of the readiness of workmen to advance if masters would show them the road. They would very much like a gauge from the Institute. Everyone complained of the want of some fixed one, and if it came from the Institute it would carry authority with it, whilst a standard to compare by could be kept at the Institute so as always to be seen; it would save a great deal of trouble. (Hear, hear.)

Mr. Glasgow stated that the Institute had appointed a committee to enquire into the subject, and the Turners' medal would be given for the best series of simple gauges that can be adopted for the watch trade. One of the conditions was that the series should be such as could be sold cheaply. (Hear, hear.)

Mr. Poole, in answer to the remarks that had been made upon what he had said in his lecture respecting the difference of cost in living between London and the Midland Counties, now stated that his information was supplied by a gentleman upon whom every reliance could be placed.

Mr. Nielson gave some particulars about the Waltham Watch Factory during the time that he was there. They paid a dividend of 50 per cent., and during the war of 100 per cent. He had gone over both Mr. Ehrhardt's and the English Watch Company's Works at Birmingham. They made a good sound watch. He was of opinion that the company could not be beaten by Clerkenwell in quality and price.

Mr. Crisp spoke about the urgent necessity that existed for a standard gauge. Chronometer makers had a slide gauge which had been used since the days of the late Mr. Pennington. With respect to working watchmakers, some of them did not seem to know apparently how many inches made a foot. (Laughter.) Workmen ought to be educated to understand gauges. With respect to work upon a large scale, he thought that no manufacturer could employ a sufficient number of workmen to carry out all his processes. There was not work enough to give. Immense capital would be required to keep the men going. What was wanted was commerce, and how that was to be obtained no man could tell. Workmen could very easily make gauges to the standard for about two shillings each gauge.

Mr. Stuart Murray rose and said that before the discuscussion closed he should like to make a few observations. Being personally known to the English Watch Company, and concluding from the allusion that Mr. Poole made to them in his lecture of February that they would be again mentioned in this discussion, he wrote to them drawing their attention to the matter, and stating that if they wished any of their productions before the meeting he would take charge of them. Their answer was before the gentlemen present. It consisted of four silver watches of various sizes and qualities, two of them being key-winding, and two keyless. One of the keyless watches was without the dial, so as fully to expose the action of the mechanism and enable it all the better to be well examined in motion. In one of the pill boxes on the table they would also find a set of keyless work complete, which they could look at separately with their glasses at their leisure. With respect to the watches it might save some criticism if he told them at the outset that none of them were quite ready for delivery, though they were all going, as they had been thrown off haphazardly for him, without any attempt at selection, and might, therefore, be taken to be, indeed, a fair sample collection of the work that was turned out. Another thing he begged to tell them, now that the watches were in their hands, and that was, that *all questions relating to the commercial aspect of the matter would have to be answered from Birmingham*, the Company not having entrusted him with that part of their case. There were, too, specimens of balance-staffs for the lowest quality watches—ordinary every-day lathe work as it was described in the paper he held in his hand—and balance-staffs with their solid steel collets and conical pivots, "a far better article than the regular balance-staff with brass collet and arbor driven in, and used for the same class of work made according to present methods." On the cards would be seen specimens of springs used both for keyless and key work. They are stamped out in rings, each ring consisting of four springs. The different stages of manufacture are shown on the card, after the metal has become a ring, up to the final polishing; they are cut into separate springs afterwards and applied as they are required. It is hardly necessary to mention that they are made with great rapidity.

[By this time all the seats had been emptied, the meeting crowding round Mr. Murray at the table to obtain specimens of the different articles, which were examined with much interest and curiosity.]

Mr. Murray continued:—In the undialled keyless watch you will see two of the springs already alluded to in place; one of them on the pendant lever, or at least on the lever that the pendant bevel-wheel takes into, and the other on the sliding click of the barrel-wheel that does duty for a ratchet in the winding. In one of the small boxes is a steel balance, with staff, roller, and ruby-pin attached, all ready to put into place. But the most wonderful production there is a potence, jewelled with its sliding bar. Now, the complicated machine that makes that is a positive marvel to every one who has seen it at work. The potence is jewelled before it reaches the machine. It is put in, set in motion, and the dove-tail groove, with the dove-tail bar to slide into it, are cut in the short space of just *one minute!* The potence groove is cut at the front of the machine, whilst the bar is cut at the back, at the same time and by the same mechanical action. The cutter that cuts the dove-tail groove works so closely that no perceptible space is discernible between it and the cut surface. In other words, the cutter can be set to work on a gauge of the 2,000th of an inch, or even less, and when the jewel is passing under it the difference between this cutter clearing the stone, or cutting it out, is said to be the almost "unseeable" space of one of those thousandths! After that, what next? This dove-tailed potence-groove, or slot, and its bar were very minutely inquired into all round. The speaker stated that the machine could be set to cut any size potence, from 10 to 22. Indeed, he added, its action seemed sarcely credible, even when he was looking at it in action. He next handed round a set of four photographs of the establishment—one of the outside, another a portion of the plate-room, a portion of the steel-work room, and the "putting up" room. He continued:—The Company worked upon the lines that "The dominant ideas of the factory or machine system may, perhaps, be arranged under the following heads; thus:—

"1. Simplicity of movement. This, of course, includes the going barrel.

"2. Such a series of sizes that the requsite machinery can readily be adapted to any of the series.

"3. The substitution, wherever possible, of steam power for hand; *e.g.*, the fiddle-bow is abolished, and all turning, drilling, and pivoting is done by power.

"4. The bringing of the whole series of processes for the entire construction of the watch under one responsibility and control; and crowning all these is the absolute interchangeability of every part of the same size through any number of instruments upon which they may be tried." In again answering a question about the grooving of the potence, Mr. Murray said that he had seen a good deal of machinery of all kinds in his day, but he had never met with anything like that. He had no intention of giving them a lecture, but, in fact, *the whole establishment was one great lecture in itself.*

Mr. Bacon thought that such a meeting as they were having would do much good in Clerkenwell. A third of the time and trouble might even now be saved by the movement-maker in every watch. If the production of the trade was to be cheapened, a subdivision of work must take place. It was quite clear that an escapement pivoter who did nothing else must beat, three to one, the man who did not specially devote his attention to it. (Hear, hear.) With respect to the underspring, for his part he would be glad if the Birmingham company would keep to it altogether, as it could only be economically done by those working large quantities. So far as foreign competition went, he had seen the other day a Swiss Breguet-spring best watch made at a price that he would be glad to take 15 per cent. lower for. They need not fear the Swiss in high-class work.

Mr. Bickley replied as closing the discussion, and dwelt with some emphasis on the absurdity of shopkeepers in second and third-rate towns in England putting their names as makers on watches which they only sell. (Hear, hear.) The actual watchmaker should be lifted above that entirely. (Hear, hear.) The public were not deceived any more than if they were told in another place that the parties who sold it retail brewed Bass's ale. (Laughter.) If the makers could deal directly with the public the buyer would save much more money, and credit would be done to the trade. (Hear, hear.) He dealt with the impossibility of one master in Clerkenwell finding work on a large scale. Coventry was very different now, both in the quality of the work and in the working, to what it was twenty years ago. There they put all there money in the trade—all their profits as they saved them up. The largest man in the town, a man probably worth £200,000, could speak of his grandfather entering the place as a working watchmaker. What was wanted in Clerkenwell was a union of commerce and capital. In Birmingham, as they had heard, a great deal of work was done by machinery, and he did not see why it could not be done in Clerkenwell. (Hear, hear.)

Mr. Glasgow, as chairman, was pleased to find that the meeting had been so successful. With regard to the subdivision of labour, if it was to be done it must be under one roof, for there was a great deal too much running about now. (Hear, hear.) The Institute hoped by its teaching to make better workmen in the future than there was before. (Hear, hear.) In his opinion, speaking from experience, Clerkenwell must either hold up its head or subside altogether. (Hear, hear.) He did not believe in the Americans as watchmakers, as, from the extent to which machinery was employed by them, there was no chance of their ever becoming anything beyond minders of machines. They send work that has been bought in Switzerland here to be completed, and then call it their own. (Laughter.) Apart from this he thought that Clerkenwell must adopt either the French or Swiss village plan, or the factory system. If they could get work done in the villages round London, it might solve the difficulty. He believed that those meetings would do good and bring out new ideas.

The chairman resumed his seat amid applause, and thanks having been voted to himself and the lecturer, a very instructive and successful meeting was brought to a termination.

TECHNICAL EDUCATION.

APPRENTICESHIP: SCIENTIFIC AND UNSCIENTIFIC.

By Silvanus Phillips Thompson, D.Sc., B.A.,

(*Continued from page* 135.)

In a little pamphlet which I have recently published, upon "Apprenticeship Schools in France," I have given a full account of the nature, organisation, and cost of many of these schools; a little additional information has since been published in the pages of the "Artisan Reports on the Paris Exhibition," already referred to. We may classify the most important of the institutions under three heads.

1. Schools which profess to give a training sufficient to qualify the pupil to enter a factory forthwith as a skilled workman, or apprenticeship schools proper.
2. Schools which prepare pupils for subsequent apprenticeship by giving them some manual and technical instruction along with an ordinary schooling, or schools preparatory to apprenticeship.
3. Institutions for giving technical instruction to the apprentices of a regular factory or workshop, or to the apprentices of some particular industry.

I.—Apprenticeship Schools Proper.

Of the first category are the three *Ecole d'Apprentis* of La Villette (Paris), Havre, and Douai, the *Ecole d'Horlogerie* of Bésançon, and the unique industrial school kept by the Frères Chrétiennes, in the Rue Vaugirard (Paris), known as the *Institution de Saint Nicolas.*

The three *Ecoles d'Apprentis* of La Villette, Havre, and Douai, are meant to train boys to become good workmen in the handicrafts in wood and metals, *i.e.*, carpenters, wood turners, cabinet makers, pattern makers, smiths, fitters, metal turners, and locksmiths. The Douai school is the oldest of these, and the least active. The Havre school, which I visited early in the present year, is in healthy operation. Some information concerning it is given in my pamphlet, and more recently Mr. Hodgson Pratt has described in the *Daily News* of October 31, 1879, the nature of this school and the scope of its operations.

The *Ecole d'Apprentis* of Paris, situated in the Boulevard de la Villette, is a school of similar character, but surpasses the Havre school in size, in the extent of its appliances, and in the general superiority of its organisation. The results attained by this school are truly striking. No pupil is admitted before thirteen, nor without his certificate of elementary education. The course of instruction lasts three years, about half the day being given to schooling, and half to practical work in one or other of the workshops. The lads, who go out at sixteen or seventeen, are able at once to rank as skilled workmen, earning a wage usually only obtained by those who have served a much longer apprenticeship in the shops, and in some cases to earn higher wages than the average skilled workman who is of age. Happily, the promoters of this school have viewed the experiment in a truly scientific spirit, and the exact date which they have kept upon all statistical matters enable a precise estimate to be drawn of the signal success attained by the school. The school was founded in 1873. Of 74 apprentices who had gone out up to August, 1877, 69 remained faithful up to the present year in the industry taught them in the school; and their average rate of payment on leaving had been equivalent to 18s. a week, reckoning 56 hours to the week's work; their average age on leaving being seventeen years and a-half. Some of these, the young smiths and metal turners, earn more than this, and receive from twenty up to thirty, and even thirty-two shillings a week, as soon as they go out to work. Now, this school is one where there is a graded series of manual exercises, where those exercises are undertaken solely to develop the pupil's skill without reference to their commercial profitableness, where no work may be attempted until the how and why have been explained, nor until the piece of work has been made the subject of a proper working drawing. It is a school where regular systematic, technical, and scientific principles are both instilled in class and insisted upon in the workshops. The instruction is not left to uninstructed workmen, but is in the hands of competent teachers, the head of the workshop staff, for example, being himself a former pupil of one of the *Ecoles des Arts et Métiers*, and thoroughly imbued with the scientific spirit, while the teacher of physics is an accomplished assistant in the Paris Observatory. The director, M. Müller, is himself animated with the spirit of the institution, and conducts excellent classes in descriptive geometry and other subjects. M. Bocquet, the superintendent of the workshops, gives a course of technological lessons, which, beginning with descriptions of tools and bits of machinery, bolts, nuts, keys, &c., leads up to a complete knowledge of machinery and of machine tools. Drawing, applied physics, applied chemistry, algebra, arithmetic, geometry, and even industrial jurisprudence form parts of the curriculum of studies. To visit this school and its workshops—and I have visited it seven times, and spent many hours within its precincts—is sufficient to dispel the notion that the rational scientific apprenticeship advocated here, and in my pamphlet on "Apprenticeship Schools," is an impossible or Utopian idea, incapable of existing anywhere, except on paper. The problem is solved; and it is now simply a question of costs how far this solution can be applied. The small collection of studies executed by the pupils of this school, which I am able—thanks to the kind co operation of Dr. Müller and of M. Bocquet—to exhibit to-night, will give but a faint idea of the works undertaken by the pupils. A further account of the school is given by Mr. Hopps on page 269 of the Artisan Reports.

Let us next refer to the *Horological School of Besançon*, which is an apprenticeship school in many respects similar to that just described, but differs from it in being devoted to the interests of but one industry. Of the nature of the practical and theoretical instruction given in this school, and of its growth, and of the important part which it has played in aiding the truly astounding development of the watchmaking industry in France, I cannot now say much. The report of Mr. Ganney upon watch and clockmaking at the Paris Exhibition adds a good deal of information to that which I have already collected, and it fully confirms the view that in an industry in which the principle of division of labour is so fully carried out, it is utterly impossible without some such institution for any skilled workman to obtain that general round of knowledge and of practice which the training in such a school affords. Mr. Ganney particularly mentions the work of the head pupil of the school, a lad 17 years of age, and who had not yet completed his third year of attendance at the school. He had carried the school prizes before him, and in addition to drawings and models innumerable, had constructed about fifty watch movements, including a fusee keyless pocket chronometer, finished and fully jewelled, and ready for hair springing, and a keyless repeater lever of complicated pattern, having not only set the jewels, but even made his own jewel holes. Mr. Ganney remarks that the wonder was how so much skill could have been acquired in so short a time as about 34 months; that as many years might have been deemed a reasonable time to learn so much; and that he doubts if the English trade contains any workman taught in England who could undertake to produce such a variety of work of equal excellence, no maker of repeating movements having been known in England for 50 years. In the face of such an opinion, from one so well qualified by practical acquaintance with the subject, can it be doubted that the method of teaching an apprentice his trade systematically and scientifically by competent men chosen specially to teach, and with a single eye to that which will promote the pupil's skill, is at least in this important industry an advance of enormous importance upon the old apprenticeship of the shops?

The *Institution de Saint Nicolas*, which I have named as an industrial school of some note, teaches no fewer than 16 different trades to pupils who go there to become apprentices. There is, however, an almost complete absence of technical teaching; the two hours' schooling given each day to the apprentices has no relation whatever to their work; and, except in map-engraving on stone, and wood-engraving, there appears to be no science or system in the trade teaching, which is done by ordinary workmen. In the two departments named some excellent work is, however, turned out, and in these departments exercises are set graded according to their difficulty, which the pupil must execute simply to gain skill.

II.—Schools Preparatory to Apprenticeship.

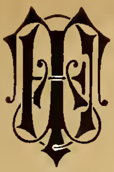
I turn now to the case of schools which prepare pupils for apprenticeship by giving them some manual and technical instruction along with their ordinary schooling.

One school, and one such only do I know, the manual school of the Rue Tournefort, in Paris, known as the *Ecole Communale.* This is an ordinary elementary school, having two workshops attached to it, in which the older scholars are tauggt systematic work for about three and a-half to four hours a day, in carpentry, forging, turning, modelling, and carving. Of the kind of work executed by pupils of this school, I am able, thanks to the kind courtesy of its director, Dr. Laubier, to show you some examples. To my mind the great advantage of such schools is not in any actual skill they impart, for the hours are too limited and the pupils too young for this; but rather in that it carries on the training of hand and eye begun in the Kindergarten, the cradle of technical education, and prevents that which is, alas, too often the case with the literary schooling prescribed by the Elementary Code of our Education Department, the growth of a distaste for manual toil liable to overtake those who do not go to work before they are 13 or 14 years old. Slight as are the exercises executed in this school, the system is nevertheless well conceived, the exercises being systematically arranged and appropriately chosen. The cost of this addition to the usual schooling is very moderate, and these manual exercises appear to bring no detriment to other school attainments.

III.—Institutions for giving Technical Instruction to the Apprentices of a regular Factory or Workshop, or to the Apprentices of some Particular Industry.

We come now to consider a very heterogeneous group of institutions and systems whose aim is to impart technical instruction to the apprentices of a regular factory or workshop, or to the apprentices of some particular industry. In France these are very numerous, and the operation of the French Factory Act of 1874 has added to their number very considerably. The provisions of this Act forbid the employment of children under twelve unless actually in receipt of a minimum of two hours' schooling a day, nor may children over twelve and under fifteen be employed more than six hours a day unless their elementary education has been completed. Unlike our English Factory Act, which recognises no schooling except the stereotyped course prescribed for "Public Elementary Schools," the French Factory Law extends its recognition to evening and half-time schools in which technical instruction, scientific or artistic, forms the main feature of the curriculum. A very large number of the manufacturers of Paris are therefore able to comply with the law by having on their premises a school-room fitted with suitable appliances, in which every apprentice is systematically taught during the period of his apprenticeship. Be it remarked, however, that many such schools existed before 1874, and the oldest are some of the best. Many of the goldsmiths and jewellers of Paris have thus little schools of art for their apprentices. M. Lemaire the famous maker of opera-glasses, has thus, for thirty years, instructed his young hands, and now two hundred of his two hundred and fifty hands are of his own training. The course here includes the study of elementary mechanics and elementary optics along with ordinary school lessons. So again, MM. Chaix and Co., the well-known printers, have had since 1862, a school of typography for their apprentices, in which the instruction is divided into three courses—elementary, technical, and supplementary. The technical course includes a course of lessons on typography and types, on the theoretical parts of printing, on reading and correcting proofs, and on engraving. The supplementary course deals with mechanics, physics, elementary notions of chemistry as applied to printing, the history of printing, and even a dose of industrial economics. The apprentice compositors work for seven or eight hours in a separate composing-room, under a *contre-maître*, whose sole business is to instruct them; and the practical exercises set them are "such as to introduce successively to their notice all the various difficulties which they must surmount, in order to understand their business and become first-rate workmen." Mr William Bright mentions this school in his report on printing amongst the reports on the Paris Exhibition.

Great Jewellery Robbery at Carlisle.—The shop of Mr. J. N. Routledge, jeweller and silversmith, was broken into on the 13th ult., and watches and jewellery to the extent of £5,000 were abstracted.



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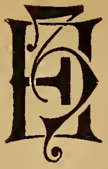

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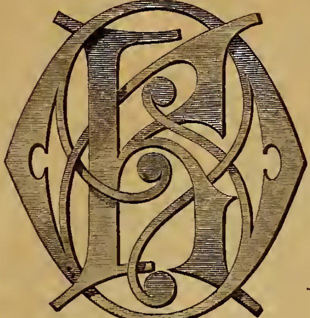

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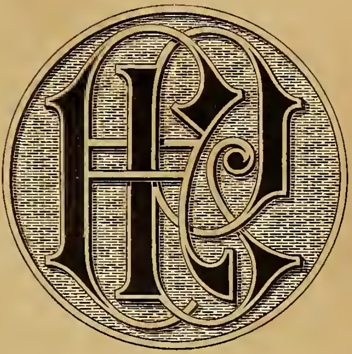

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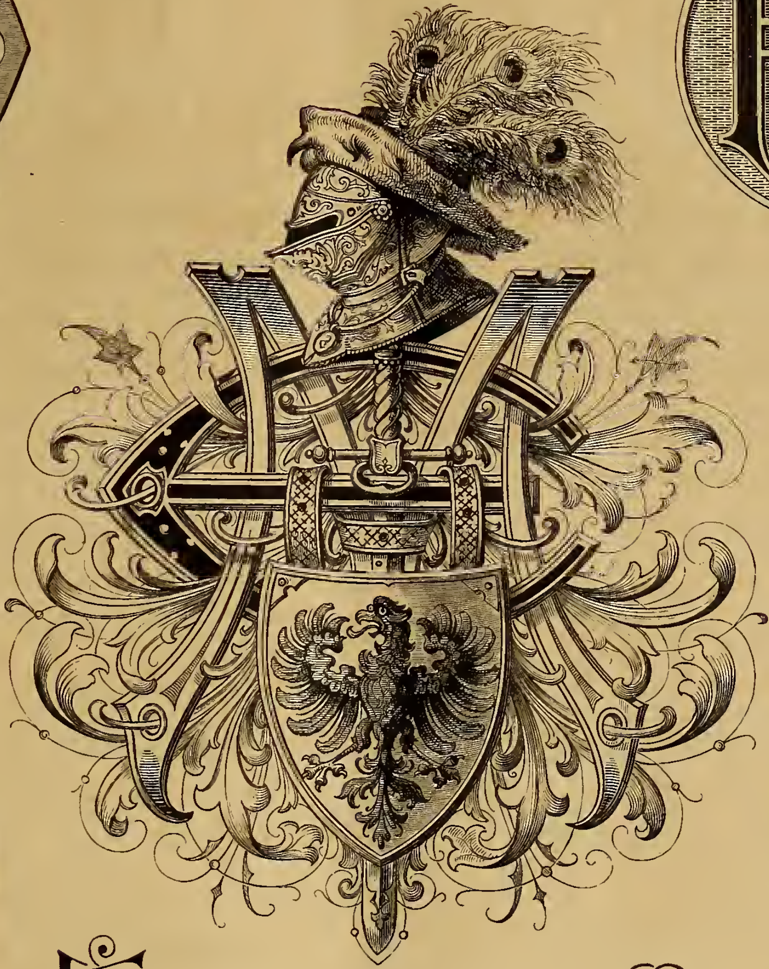

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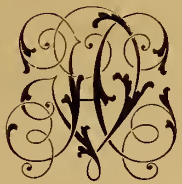

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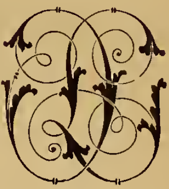

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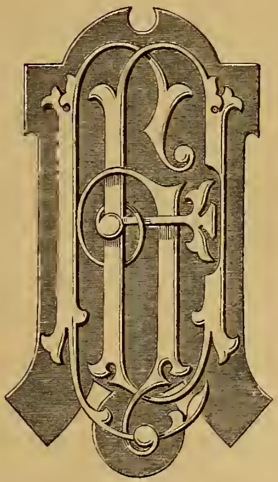

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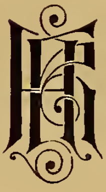

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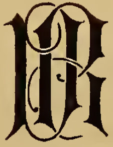

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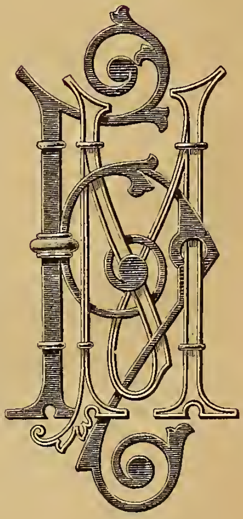

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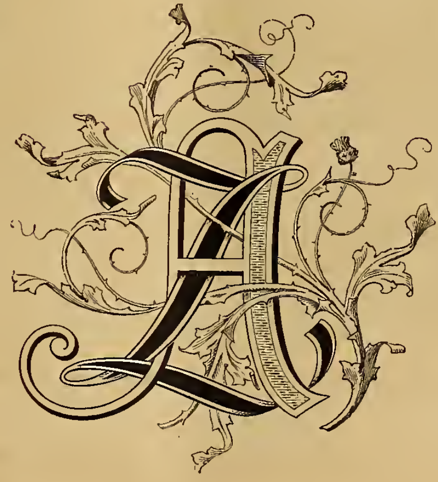

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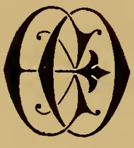

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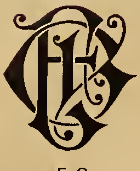

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EXAMPLES of MONOGRAMS DESIGNED and EXECUTED by Messrs. MARTIN GERLACH & CO., of VIENNA.

THE
WATCHMAKER
JEWELLER.
AND
SILVERSMITH'S
TRADE
JOURNAL.
W H TILBY

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

Entered at Stationers' Hall.—Registered for Transmission Abroad.

CONTENTS.

	PAGE
The Construction of a Simple but Mechanically Perfect Watch	149
Practical Instructions to Jewellers, Silversmiths and Electro-platers	151
Hallmarks and Trade Marks	152
Manufacture of Antique Plate	153
Our Tools	153
Awards of the International Exhibition at Sydney	154
Art Work in the Precious Metals	156
The New Indian Museum	156
Hints to Repairers	157
A Few Words on Gems and Precious Stones	158
The Art of the Silversmith	159
Technical Education	160
Patents	i
Monthly Record of Bankruptcies	ii
Directory	iv
Advertisements	i—xii

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THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.*

By M. Grossmann, Watch Manufacturer, Glashuette (Saxony).

(*Continued from page* 138.)

CHAPTER II.

The Barrel and Main-Spring.

24. An attentive consideration of the way in which this element of the watch is executed by modern watch-manufacturers will result in the conviction that the care which is due to an object of such importance has not been bestowed upon it. This fact is the more surprising, as a great number of cheap lever watches are produced in these days, with escapements so badly made that they can only be brought to a tolerable vibration by an excess of motive power.

25. In arranging the barrel of a watch, the manufacturer ought to be thoroughly imbued with the principle that the height and diameter granted for a watch should determine the breadth and thickness of the main-spring. It is of the utmost importance to make the barrel as high and wide as the dimensions of the watch will permit. For this purpose it will prove a good proportion to multiply the outer diameter of the pillar-plate by the fraction 0·47. This will be the diameter of a barrel-wheel as large as the size of the watch will admit.

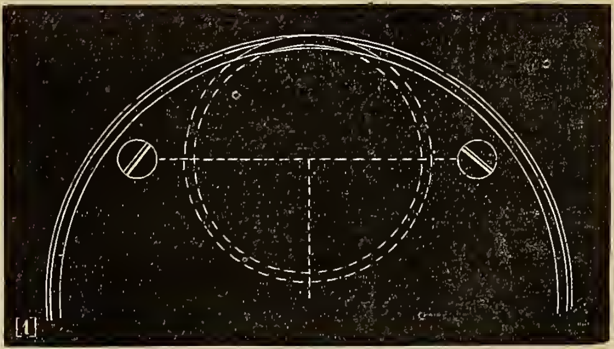

Fig. 1.

It is even possible to go a little beyond this limit, by placing the toothed part of the barrel a little lower than it is commonly done, in order to lodge this largest part of the barrel in the hollow space of the middle rim of the case, where there is always space enough, especially in hunting cases, if the case springs are properly placed.

In this case, the diameter of the plate may be multiplied by 0·485, to obtain the diameter of the barrel.

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26. The height of the barrel in a three-quarter plate movement ought to be the sum of the height of the pillars and the thickness of the pillar-plate, less a space sufficient for the free movement between the top and bottom of the barrel and the frame-plates, and the necessary thickness of the bearings for the lower end of the barrel arbor.

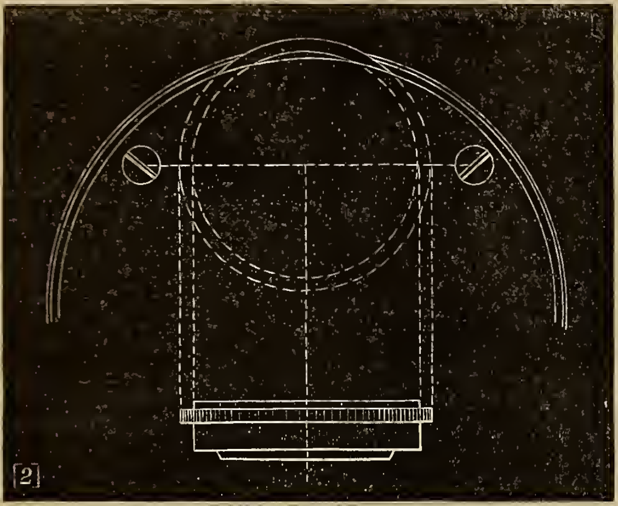

Fig. 2.

27. It will be easily understood that a watch, the escapement and depths of which are imperfect, and made in a careless way, will require a powerful main-spring, while in a carefully made watch any excess of power can be avoided; and there is besides a judicious economy of space in the barrel. This will allow the employment of a long and thin main-spring, which, owing to its suppleness, is less liable to accident, and, by the number of turns it makes in the barrel, affords the advantageous resource of selecting the middle turns of the development of the spring for the daily march of the movement, and thus to obtain a greater uniformity of motive power.

28. It will also be found advisable to reduce the breadth of the toothed rim of the barrel as nearly as possible to the amount required for the length of the teeth. There are many watches, the barrels of which, already too small in diameter, have also the toothed rim of an excessive breadth, so that much of the space due to the spring is entirely lost. It is quite obvious that a barrel of that kind causes a double loss of power. Not only must the spring be thinner and weaker than it might otherwise be, but also the inner radius of the barrel, which is the lever of power, is shortened; while the radius of the toothed part, which is the lever of resistance, is the same. The same consideration indicates also, that the sides of the barrel ought only to have the thickness required for fastening a solid hook.

29. If all the proportions of the barrel are as they ought to be, a spring of the thickness of $\frac{1}{80}$ of the inner diameter of the barrel will be quite sufficient to produce an adequate vibration in a watch with escapement and depths a little carefully made. Such a spring, if the centre of the arbor is one-third of the inner diameter of the barrel, has a development of more than six turns, of which the middle ones may be selected for the daily march of the watch.

30. The manner in which a barrel arbor is constructed varies very much in different countries. I do not hesitate a single moment to disapprove the system in general use in Swiss watches. In most of them the lower end of the arbor has no bearing and support at all, and the barrel is maintained in its place by the ratchet, which is made out of the solid of the arbor. This system shows clearly that the preference which it enjoys, is merely due to a blind routine. It offers neither economy of time in the manufacturing and in the repairing, nor a better distribution of room for flat watches; besides it is inferior in point of solidity and durability. In all watches, in good as well as lower class work, the barrel arbor ought to be supported at both ends by solid bearings; in the former for the sake of greater solidity, and in the latter, also, for that of cheaper production.

31. There are two modes of executing these free standing barrel arbors. One of them has the ratchet forming part of the arbor itself sunk from the upper side into the barrel bridge, and is held in its place by a cap with three or four screws; these screws, having hardly more than three or four threads in the substance of the bridge, are the only means of securing the stability of the receptacle of the moving power in the watch. Every repairer knows, from oft-repeated experience, that this adjustment is an inexhaustible source of trouble, and that the inner face of the cap or the bottom of the sink are subject to rapid wear by the daily winding, if the oiling of the frictional surfaces has been neglected. The consequence of this wear is an excess of shake of the ratchet and of the whole barrel. Any defect of this kind is very serious, because the barrel and centre-wheel, the two largest moving parts of the train, have, by necessity, their surfaces very close to each other.

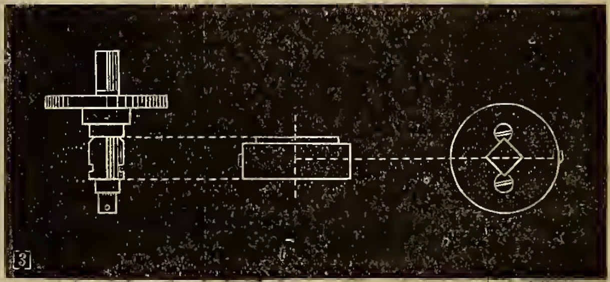

Fig. 3.

(*To be continued.*)

Pneumatic Clocks.—The system of the Viennese Company, introduced to Paris some time ago, is being rapidly extended in that city. M. Saunier, in his *Revue Chronométrique*, tells us that time is now *laid on* for 5 centimes or one halfpenny per day. At this rate *Observatory Time* will soon become as common as gas.

Trade Marks in Switzerland.—The Swiss Federal Council has at last passed a Trade Marks Registration Act, by which trade marks, having been properly registered abroad, will receive full and complete legal protection in Switzerland. It is to be hoped that a Patent Act will soon follow this judicious step.

Italian Coral.—There is a fair trade in Italian coral sent to India, chiefly to Calcutta, amounting to about 80,000 lbs. a year. Formerly the coral fishers, a poor community mostly inhabiting Torre del Greco, near Naples, were in the hands of dealers, to whom they sold the coral as they fished it. These dealers kept the coral or shipped it according to the state of the market. The fishers have now got out of the hands of the dealers, who made handsome gains out of them, and ship on their own account. Being men of but small capital they must ship the produce of their fisheries as soon as possible. In India the demand fluctuates with the seasons, but the demand which has hitherto on the whole been much in excess of the supply, keeping up prices, is now said to be falling short of it. The revolution in the trade tends to throw supplies on the market in excess of the consuming capacity except at reduced prices. The trade, however, is but a small one on the whole.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. XIV.

(*Continued from page* 139.)

Solutions for Brass Baths.—The ordinary cyanide of potassium is preferred to the pure article in most workshops, on account of its lower price; but the real value and dissolving property of ordinary cyanide are so variable that it is impossible to assign it an exact weight in the composition of a brassing bath. The following is a general method by which a bath of brass may be prepared with any kind of cyanide:—1. Dissolve together in 2 gallons of water—

Sulphate of copper, 8 ounces;
Sulphate of zinc, 8 to 10 ounces; or
Acetate of copper, 4 ounces; with
Fused proto-chloride of zinc, 4 to 5 ounces;

and add a solution of 30 ounces of carbonate of soda, which produces a precipitate of the carbonates of copper and zinc; allow this to settle; then decant the supernatant liquor, and replace it by fresh water two or three times, after as many settlings. Then pour on 2 gallons of water containing in solution 30 ounces of carbonate of soda and 15 ounces of bisulphite of soda; while stirring with a glass or wooden rod, add ordinary cyanide of potassium until the liquor is perfectly clear, or until nothing but the greyish-black iron, found in the cyanide, or the brown red oxide in the sulphate of zinc, remains in suspension. An additional quantity of about an ounce of ordinary cyanide improves the conducting power of the liquor. Operators employing pure cyanide of potassium, or the ordinary cyanides with a constant and known composition, I can recommend the following recipes, proved successful by daily practice:—

Cold Brass Bath for all Metals:—

Carbonate of copper, recently prepared, 4 ounces;
Carbonate of zinc, recently prepared, 4 ounces;
Carbonate of soda in crystals, 8 ounces;
Bisulphite of soda, 8 ounces;
Cyanide of potassium, pure, 8 ounces;
White arsenic, one-tenth of an ounce;
Water, about 2 gallons.

This bath is prepared as follows:—Dissolve in 3 pints of water 5 ounces of sulphate of copper and 5 ounces of crystallised sulphate of zinc, and add a solution of 14 ounces of carbonate of soda in a quart of water. A greenish precipitate of mixed carbonates of copper and zinc is formed; stir well, and allow to deposit for several hours. The supernatant liquid holding the useless sulphate of soda is thrown away, and replaced by nearly two gallons of water, in which are dissolved the bisulphate and carbonate; dissolve together in the remaining warm water the cyanide of potassium and the arsenious acid, and pour this liquor into the former one, which is rapidly decolourised, and forms the brass bath. Filter if necessary. Arsenious acid causes the deposit to be bright, but if in too great a proportion may give a white or steel grey colour to the metal. This inconvenience is slight, as the yellow colour soon predominates. The arsenious acid may be replaced by soluble arsenites of potash, soda or ammonia, but the proportions must be doubled. The baths for cold brassing are generally placed in wooden tanks lined inside with gutta-percha which resists their action for a long time. The sides of the tank are also lined with one or more brass sheets joined together, connected with the last carbon or copper of the same battery, the intensity of which is regulated by the surface of the articles to be electroplated. The articles are suspended by copper or brass hooks to stout rods of the same metal, all connected with the last zinc of the battery. The losses of the solution are to be repaired by additions of copper and zinc salts, and arsenious acid dissolved in cyanide of potassium. The operator will determine the needed substances from the rapidity of the deposit, its colour, and so on. If the deposit is too slow, try whether the bath will absorb the salts of copper and zinc without the addition of cyanide. If the coat of brass has an earthy and ochreous appearance, and especially if the liquor is blue or green, add cyanide of potassium until perfect decolourisation takes place. If the deposit is dull and unequal, add a small quantity of arsenious acid dissolved in cyanide. If the deposit is too white, or of a greenish white colour, add the salt of copper, alone or dissolved in cyanide. When the bath after long use has become overloaded with salts, the specific gravity is too great for the easy passage of the electric current, and the liquor must be diluted with water until it works satisfactorily. The specific gravity of a brass bath may vary from 5° to 12° Baumé. The pieces, before brass electro-plating, must be perfectly cleansed in the same way as zinc or iron; if the brass deposit is irregular, remove the objects from the bath, rinse scratch-brush, and put again into the bath until the colour and thickness of the deposit are satisfactory. Scratch-brush again, and, if necessary, rinse in hot water, dry in warm saw-dust of white wood, and put in the stove room. The last three operations are indispensable for hollow pieces.

We shall now give other formulæ for brassing based on the use of ordinary cyanide of potassium.

The brassing of very small articles which cannot be suspended is done in a ladle, in the same manner as indicated for the coppering of such small objects.

For the brass deposit on zinc and iron to be lasting, the deposit must not be too thin; it must be scratch-brushed, rinsed in water rendered slightly alkaline by the addition of a few thousandths of lime, and completely dried in the stove.

Articles which are ultimately bronzed receive generally only a brass colour, by leaving them in the bath from ten to twenty-five minutes.

We know of no method of brassing by simple immersion, although a brass colour is produced on small iron or steel articles by shaking them for a considerable time in a solution of—

Water, 1 quart;
Sulphate of copper, ¼ ounce;
Protochloride of crystallised tin, ¼ ounce.

The tints may be regulated by the quantites of the two salts.

Brass Bath for Steel, Wrought and Cast Iron, and Tin.—Dissolve together in 14 pints of soft or rain water:—

Bisulphite of soda, 7 ounces;
Cyanide of potassium, No. 2, 17 ounces;
Carbonate of soda, 34 ounces.

To this solution add the following, made in 3½ pints of water:—

Acetate of copper, 4½ ounces;
Neutral protochloride of zinc, 3½ ounces.

The two liquors become colourless when mixed; ammonia must not be used for brass electroplating baths for iron, especially in cold baths.

(*To be continued.*)

According to a report from the United States Consul at Birmingham, Mr. J. Francis Brame, the exports from that city to the States in the shape of jewellery and fancy goods during the quarter ending March 31st, 1880, amounted to £16,899 5s., and during the same period last year to £12,067 14s. 7d.

HALLMARKS AND TRADE MARKS.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Mr. Editor—Sir,—The trustworthiness of a trade mark as compared with a hallmark appears from the opinions expressed by those who gave evidence before the Commons Committee on the silver trade to be generally very much doubted.

Writing from a town in which the value of trade marking as a guarantee of quality has been well understood for generations past, it may be interesting to many of your readers to learn something of the way in which the very extensive and varied business in goods made of steel is carried on.

The Cutlers' Company of Sheffield is the body that is looked upon as representing the staple trades of the town, and was first incorporated by charter in the reign of James I. From very humble beginnings it has grown in importance with the growth of the town and its trade, so that in the present day it speaks for a community which applies a very large and constantly increasing capital in the production both of the material steel itself and the very varied forms into which that material is worked up.

In reading down the list of names of the gentlemen who form the court or governing body of the company, it will be found that there is not one who has not now or at some former time been entirely connected with some one of the manufactures in which steel is a principal material. Here, then, if anywhere, might be found an organised body capable of interfering knowingly with an important trade in which the quality of the material used is perhaps of greater importance under certain easily imagined circumstances than any other in the world. But at the present day the company besides dispensing its hospitality on certain important occasions has but one other class of duties to perform, and is confined in its action to the granting, registering, and protecting of trade marks. No one has any right to know whether his neighbour is making his cutting instruments of Bessemer at £10, or special brand steel at £100 per ton, that is left to the discretion of the manufacturer and the requirements of his customers, and there is at the present hour the most perfectly satisfactory evidence to be had that this freedom in working has not resulted in any deterioration in the quality of the goods made by houses which have always made quality their first consideration; those are the houses that know best the value of a trade mark, and will defend it even at the heaviest cost.

Last autumn an idle tale found its way into the *Times* to the effect that our cutlers' work had so degenerated that even Sheffield merchants had their warehouses filled with goods of foreign make; appearing where it did, it found ready credence among the Jeremiahs of the country, and much ink was misused in upbraiding and cursing the supposed delinquents. But it was all false in fact and inference. After a time the Master Cutler, speaking in the name of the company, gave an unqualified denial to the unfounded calumny; and an old workman who had the honour of his native town at heart took at random from among hundreds similar a few penknives, which he sent to the editor of the *Ironmonger*, with a challenge to the world to produce others of any foreign make that would stand the severe test of which would make the greatest number of quill pens without blunting. But the challenge was never taken up.

It is not likely that a trade mark the reputation of which has been the growth of much more than a century, as some of the best Sheffield marks are, will be jeopardised by the use of inferior material or workmanship; it would be but penny wisdom and pound foolishness, and would assuredly recoil on the unwise manufacturers and workpeople.

At the present hour those houses which have an established name in America are doing as great and, in some instances, even a greater trade than at any former time, and that notwithstanding the import duties, ranging at from 30 to 60 per cent. They have of late years strained every nerve to supersede the English by home-made goods, yet the writer has it on most indisputable authority that even in what is apparently so simple a matter as a shoemaker's or a butcher's knife our most noted house in that line is this year in receipt of single orders for thousands of dozens of their goods at once. A butcher of Chicago, where millions of live stock are annually slaughtered, will buy his knife only by mark, and pays just twice as much for our most noted Sheffield brand as he would for that of almost any other maker; he buys for its wearing qualities, and he knows by the mark that he will have full value for his money. That mark is a valuable asset, and would sell for a large sum.

Could not our silversmiths gain a similar reputation by similar care? A very moderate time would serve to establish the name of a manufacturer as one who could be relied on for always supplying silver of a high standard. Mr. Farrer has more than once called attention to the fact that there is no material we buy the quality of which can be so easily tested as gold or silver, and he urges that you may contract with the seller for metal of a certain quality, and if the quality should prove inferior to contract you could at any time return it on his hands.

Those who have a voice in the London Goldsmiths' Company's affairs are not like the others we have been writing about; they are not, as a rule, in any way acquainted with the trade over which they exercise so great authority.

Looking down the list of gentlemen composing the court of the company, it is surprising to note how few of them have had any occupation from which they could gain the smallest information on the art of working in gold or silver; moreover, if one may judge from those selected to represent the company as governors of the Technical Institute, it would appear that a practical knowledge is looked on as a disqualification rather than otherwise. There is more than one gentleman on the court whose whole active period of life was spent in successful manufacturing of very high quality, yet not one of these has been put into a position for which their antecedents so entirely qualified them. Who then can wonder at the muddle the trade has got into?

Perhaps certain remarks of Mr. Bagehot may throw a ray of light upon the cause of these curious effects. Writing of bureaucrats or permanent office holders, he says, "It is an inevitable result that they will care more for routine than for results," or, as Burke puts it, "that they will think the substance of business not to be much more important than the forms of it." Their whole education and all the habit of their lives make them do so. They are brought young into the particular part of the public service to which they are attached; they are occupied for years in learning its forms; afterwards for years in applying those forms to trifling matters. They are, to use the phrase of an old writer, "but the tailors of business, they cut the clothes, but do not find the body." Men so trained must come to think the routine of business not a means, but an end, to imagine the elaborate machinery of which they form a part, and from which they derive their dignity, to be a grand and achieved result, not a working and changeable instrument. The very means which best helped you yesterday may very likely be those which most impede you to-morrow; you may want to do a different thing to-morrow, and all your accumulation of means for yesterday's work is but an obstacle to your new work."

Did space permit, it would not be difficult to apply those words very closely to the governing influence at Goldsmiths' Hall. Power has been gained and held there mainly by reason of the small number of members of the court who can speak as practical men; their views are of small account as they are always outvoted.

But Mr. Gladstone is going to do what he long ago threatened to do, and throw open to the gaze of the world those very close corporations—the City Livery Companies. That much good will result therefrom is the belief of

May 26th, 1880. An Old Hand.

MANUFACTURE OF ANTIQUE PLATE.

The manufacture of pseudo-antique articles in bronze, china, and plate is carried to a greater extent than most people are aware of. It is no exaggeration to say that this stuff is manufactured and sold in tons. The ways in which the public are imposed upon, and the Government, in many cases, defrauded by those who manufacture and vend it are various. First, there is what may be called the "hereditary plate trick." This plan is to get up articles after the antique, and to engrave upon them a fictitious inscription as, *e.g.*, "Presented to Lord A——, by his esteemed friend the Earl of B——, on his coming of age, A.D. 1750." The next step taken by some ingenious swindler is to write to some descendant of Lord A——, or of the Earl of B——, informing him that Mr. —— has obtained possession of an interesting *relique* of his distinguished ancestor, and to suggest the advantage of his lordship keeping it in the family. Then there is what may be styled "the ordinary trick" of the trade. The method here lacks the invention of the other, but it is sufficiently ingenious for the gulls for whom it is intended. The dealer purchases some ancient article, say a salt-cellar, worth about £1 sterling. He then takes this to some needy and unscrupulous silversmith, and induces him to clip the hall-mark from this genuine article and to solder or affix it to the bottom of some spurious article of a much larger size. Sometimes the silver of the latter is of a much inferior quality to that of the former, but not always. The article is then displayed in the dealer's window, with a well-devised advertisement, and sold as a genuine antique at a fancy price.

The "spoon trick" is probably the most lucrative method of swindling the public known to the *pseudo*-antique artificer, and at the same time the most difficult to detect. It is managed as follows:—The dealer purchases some old spoons, and, cutting off the shanks, beats the portion on either side of the hall-mark out thin, and then incorporates it with some vessel of inferior workmanship; or, cutting out the mark only, solders it into the "wire" running along the base of a cup or vase. This can be done by an ordinary workman so neatly as to defy detection by any but an expert. In all these instances it will be observed that a genuine mark is used, the imposture consisting solely of fixing the antique stamp to a modern vessel, and thereby inducing the unwary customer to pay an exorbitant sum for the article. But there are members of the fraternity of knaves who descend to a deeper depth of rascality. Probably they do not see the advantage of being nice in iniquity. At all events they do not scruple to forge the hall-mark as well as the age of the article which they sell. This is easily accomplished with the aid of Chaffer's book of hall-marks, which was originally intended as a shield to honest dealers, but which has become a two-edged sword in the hands of knaves. To give the article thus stamped with forgery an antique appearance, the dealer oxydises it with sulphur fumes, and sells it for twice or twenty times its value. Lastly, there is the "foreign plate trick." This consists of manufacturing articles in imitation of German, Dutch, and other foreign productions, and marking them as if they were such. The dealer by this means robs the Government of the duty of 1s. 6d. an ounce, which he would otherwise have to pay, and in many instances obtains the price of genuine silver for a composition little better than nickel.—*Inventors' Record.*

OUR TOOLS.

Under the name of the "multiple," Mr. J. H Perrenoud, of Cortaillod, Switzerland, has introduced an improved lathe, which deserves the special attention of watchmakers. Considering the many applications of this valuable instrument to watch work, it is certainly very appropriately named.

It consists of the independent bed, *a a*, 40 centimetres long, in which the bearings, etc., are fixed by means of eccentric levers. It is provided with a longitudinal rib which admits of its being secured at will and rapidly on the cast-iron foot, *b*. The latter has a locking screw, *c*, acting on a movable collar, so that the bed can be stopped at any point of its length.

The double collar plate, *d*, comprising an arbor moving in two reversed cones, and pierced from end to end for the passage of the cylinder and the traction hook destined to lock the jaws; the face plate, *e*, with double prongs closing in front, a disposition which allows the face-plate to approach the cone-plate, and thus diminishes vibration.

The grooved pulley, *f*, fixed on the arbor.

The movable and rapid unlocking gearing, *g*, admitting a quick change of the motor's movement. The handle, *h*, is a sliding one so that the arm of the lever can easily be lengthened or shortened.

The block, *i*, adjusted concentrically to the platform by a circular rim and fastened with three bolts. On this block are fixed wheel, *k*, with graduated sinks, which will grip (perfectly round) any diameter between 4mm. and 22mm., the wire, *l*, in steel and bronze, the blocks, *m*, and the cutter bar for cylindrical turning.

The slide-rest, *n n*, graduated for flat, cylindrical, and conical turning, to a given angle. The metrical screws, *o o*, are stopped by a shoulder and counter, indicating the 1-100th of a mm.—this secures the regular windage of the screw.

The burin-holder, *p*, takes every possible position, and its locking is independent of the burin. The platform, *q*, of the small rest is provided with grooves in which the cocks are placed, destined to lock the pieces to be cut parallel with the face of the supporting plate. For fraising in the direction of the arbor of the lathe, the grooved square, *r*, is used for placing it on the small rest. This support has a vertical rest, so as to obtain a movement suitable for every direction of the object to be operated upon.

This multiple lathe can be transformed into a simple one by taking off the accessories enumerated above, and by substituting the two stocks, *s s*, and the rest, *u*. The general arrangement will be readily understood by a glance at the Supplement illustrating this lathe. The manufacturer informs us that the lathe is supplied with or without the accessories, at the option of the purchaser.

Spurious Watches.—At a meeting of the Metropolitan Pawnbrokers' Protection Society, we learn from the *Pawnbrokers' Gazette*, some watches were shown which had been got up for the purpose of deception. It was stated that they had been largely sold among watchmakers, some of whom had sought to pledge parcels of them. They were very well got up, or they would not have imposed upon men who should have been good judges. The following is their description:—They are keyless watches, with engraved cases, inside which is stamped a garter bearing the words "warranted gold," white dials with crystal front; the movement is horizontal, and jewelled in eight holes. The cases are simply *brass*. They have been sold at 55s. gross, and are worth less than 20s. each.

AWARDS OF THE INTERNATIONAL EXHIBITION AT SYDNEY.

Great Britain.

Victor Kullberg, London, chronometers, 1st degree of merit.
Ditto ditto watches, 1st degree of merit.
Ditto ditto gas governors for testing chronometers, commended.
Nicole, Nielsen & Co., London, watches, 1st degree of merit.
Castelberg & Co., London, watches, 2nd degree of merit.
Thos. Russell & Son, London, watches, &c., 3rd degree of merit.
F. Bachschmid, London, watches, 4th degree of merit.
Walker & Hall, Sheffield, silver-plated ware, &c., 1st degree of merit.
Martin, Hall & Co., Sheffield, silver-plated ware, &c., 1st and special degree of merit.
Hardy Brothers, London, silver and electro-plate, 1st and special degree of merit.
Ditto ditto jewellery, 1st degree of merit.
Flavell Brothers & Roberts, London, silver-plated ware, 1st degree of merit.
Ditto ditto jewellery, 1st degree of merit.
Wm. Udal & Co., Birmingham, silver-plated ware, 3rd degree of merit.
Shaw & Fisher, Sheffield, Britannia metal, nickel and plated ware, 2nd degree of merit.
Zimmerman & Co., London, composition and real bronzes, 3rd degree of merit.
Yates & Sons, Birmingham, electro-plated ware, 3rd degree of merit.
Perry & Co., Limited, Birmingham, solitaires, 3rd degree of merit.
W. Hick, Huddersfield, solitaires with special fastenings, 4th degree of merit.
Levetus Brothers, Birmingham, Canadian gold jewellery, 4th degree of merit.
Robotham & Cranmore, Afghanistan gold jewellery, 4th degree of merit.
S. Chatwood, London, &c., safes, 1st and special degree of merit.
Milner's Safe Co., Liverpool, &c., safes, 1st degree of merit.
Sicker Safe Co., Birmingham, safes, 2nd degree of merit.
J. Tann, London, safes, 2nd degree of merit.
G. Price, Wolverhampton, safes, 2nd degree of merit.
F. Whitfield & Co., Birmingham, safes, 3rd degree of merit.

United States.

American Watch Company, Waltham, Mass., Boston, New York and London; gold and silver watches, &c., two special and five 1st class awards.
Seth Thomas Clock Co., Bristol, Conn., clocks, 2nd degree of merit.
Waterbury Clock Co., Waterbury, Conn., clocks, 2nd degree of merit.
Ithaca Calendar Clock Co., Ithaca, New York, clocks, 2nd degree of merit.
Ansonia Clock Co., Ansonia, Conn., clocks, 2nd degree of merit.
Gorham Manufacturing Co., Providence silver and plated ware, 1st and special degree of merit.
Reed & Barton, Taunton, Mass., silver-plated ware, 1st and special degree of merit.
Simpson, Hall, Miller & Co., New York, silver-plated ware, 2nd degree of merit.
Meriden Britannia Co., silver-plated ware, 3rd degree of merit.

France.

Christofle & Co., electro-plated ware, 1st degree of merit.
Quinet & Richard, Paris, clocks, 1st degree of merit.
A. H. Rodanet, Paris, chronometers, commended.
L. B. Tribandeau, Besançon, watches, 4th degree of merit.

Germany.

J. F. Weule, Hanover, church clocks, 2nd degree of merit.
Gustav Becker, Silesia, clocks, 2nd degree of merit.
Furderer, Jaegler & Co., Baden, clocks, 4th degree of merit.
A. Lange & Sons, Dresden, watches, 1st degree of merit.
Würt. Uhrenfabrik, Schwarzwald, control watches, 1st degree of merit.
Koch & Bergfeld, Bremen, silver-ware, 1st degree of merit.
F. E. Kurth, Berlin, silver ware, 2nd degree of merit.

Austria.

Anthony Schlesinger, Vienna, clocks, 4th degree of merit.

Switzerland.

L. Audemars, Brassus, watches, 1st degree of merit.
International Watch Co., Schaffhausen and London, 3rd degree of merit.
Ernst Eugster, collective exhibit of musical boxes, 1st degree of merit.

Belgium.

T. Omnoyez, Brussels, marble clocks, &c., 1st degree of merit.

New South Wales.

J. Cochran, Darlington, astronomical clock, 1st degree of merit.
J. M. Smith, Sydney, watch and clock wheels, 1st degree of merit.
W. E. Toose, Sydney, electro-plated ware, 3rd degree of merit.
E. Jones, Sydney, silver ware, 1st degree of merit.
J. Maclean & Son, Sydney, electro gold and silver plating, 2nd degree of merit.
W. Kerr, Sydney, silver ware, 2nd degree of merit.
A. F. Delarue, Sydney, silver ware, 2nd degree of merit.

South Australia.

J. M. Wendt, Adelaide, silver and plated ware, 1st degree of merit.
H. Steiner, Adelaide, silver and plated ware, 1st. degree of merit.

New Zealand.

M. Sandstein, Christchurch, silver epergne, 2nd degree of merit.
B. Petersen, & Co., Christchurch, claret jug and cups, (special), 1st degree of merit.

To give our readers a more exact idea of the class of goods for which the above awards were made in the horological section, we reprint the report of the jury, which appeared in the *Sydney Morning Herald* of the 9th April :—

"We adjudge to the American Watch Company of Waltham, Mass., U.S.A., a first-class award and such other special distinction, diploma, medal, or award as is consistent with the duties and obligations of the honourable Sydney International Commission, for the largest and most complete exhibit of horological instruments examined.

"They also propose, as the only means by which their appreciation of the merits of the production of this company can be adequately or equitably recognised by the Committee on Judging and Awards, that a separate first-class award be given for the time-keeping qualities of all grades of these watches.

"Also a separate first-class award for the perfection of this system of watchmaking, and the improvements in the mechanical parts of the watch, being notably in the main spring and going barrel, the patent safety pinion, the perfect epicycloidal form of all the teeth of the train, in every grade of watch alike, and the isochronal adjustment of the balance spring.

"Also to Charles V. Woerd, mechanical superintendent of the American Watch Company, Waltham, Mass., United States America, a first-class award for his new mode of compensating balances.

"Also a separate first-class award for the improvements in cases, the number of artistic forms and designs used, the beauty and elegance of their finish, and for their new and indestructible method of enamelling.

"Victor Kullberg.

"The display of marine chronometers by this maker, with the Observatory ratings, was of the very first order. Every part of those instruments was remarkably well made, and the modifications of some of the balance wheels worthy of special attention. Adjudged a first-class award.

"The display of watches by the same maker, although small, commanded attention from their very nice finish in all parts. As will be seen from the report and diagram of Professor Russell, they are good timekeepers, especially the one having the chronometer escapement. This style of watch, however, is of too delicate construction and too costly to fully meet the requirements of any considerable public want. The same objection will hold good as to the lever escapements as far as cost or economy is concerned, they being comparatively too high-priced. Representing a certain class of manufacture, they are of the first order of merit, and adjudged a first-class award.

"The 'gas governor,' exhibited by the same maker, an instrument for regulating the amount of heat in the testing of chronometers, is commended as a useful invention.

"Nicole and Nielsen.

"This exhibit, made specially for the Exhibition, comprised a full line of plain levers, split seconds, chronographs, calendars, repeaters, etc., and was a representative display of their peculiar style of manufacture in all its details. The cost of these watches, compared with others of similar construction and finish, was excessive; and, while they show good timekeeping qualities, they do not equal that of other exhibits.

"As representing their own methods of construction, they are of the first order of merit, and are adjudged a first-class award.

"Thos. Russell & Sons

exhibit a full line of their manufacture, which, upon comparison with other exhibits of the same general character and construction, places them in the third order of merit, and they are adjudged a third-class award.

"F. Bachschmid

exhibits a class of cheap watches of very inferior workmanship and finish, of the last order of merit, and adjudged a fourth-class award.

"Castelberg & Co.

exhibit a meritorious line of watches in many respects of good finish, and not excessively high-priced for their performances, of the second order of merit, and adjudged a second-class award.

"A. Lange & Söhne

exhibit a class of watches possessing many elements of merit and of superior finish in many respects and at a cost which is quite reasonable. That the watches are constructed upon scientific principles, and are intended as reliable timepieces, is shown from Observatory tests. The variations show that care has been taken to approximate a perfect adjustment, and that a partial success has been attained. A peculiarity in the construction of the balance wheel, having a horizontal split from the timing second holes each way, is noticeable, which we fail to understand. This exhibit was made expressly for this Exhibition, and Observatory rates sent with each watch, and as a representative exhibit, although small, was the second best examined, and is in its class of the first order of merit, and adjudged a first-class award.

"The Wurtembergische Uhrenfabrik

exhibit watchmen's control clocks and railway clocks for registering the time and duration of delays upon the line, of the first order of merit, and adjudged a first-class award.

"Louis Audemars

exhibits a wonderful class of complicated watches, calendars, repeaters, chronographs, etc., etc., combined in one watch, and elaborately cased and artistically finished. The great element of merit in this exhibit is in the combination of the great number of unusual functions for a watch, and by skill in workmanship and mechanical science securing a correct performance.

"The enormous cost of these watches is an effectual embargo on their use to any except the very few, and their utility is, therefore, very limited. In their class they are, however, of the first order of merit, and adjudged a first-class award.

"G. Tribandeau

exhibits a considerable collection of watches in a great variety of cases of a class of workmanship, finish, and performance; calling for the fourth order of merit, and are adjudged a fourth-class award.

"A. H. Rodanet

exhibits two marine chronometers only; one of which was broken, and the other out of order; commended.

"International Watch Company

exhibit a collection of watches of the third order of merit, and adjudged a third-class award.

"In concluding this report, the judges very much regret the limitation in time which has prevented them securing position tests of this very interesting exhibit in horology, as much on account of the exhibitors as on their own account. Such advances have, in the last few years, been made in this science that, in the interest of the public as well as of the manufacturers, a sufficiency of time is desirable to make tests in five or six positions, and 14 days should be allowed to each position. Tests for heat and cold, and an opportunity to carefully note barometric and thermometric influences upon the various systems of adjustment, would be very valuable and interesting.—Respectfully, etc.

"Gregory P. Harte, Chairman, United States.
"H. C. Russell, B.A., F.R.A.S., Great Britain.
"J. M'Garvie Smith, New South Wales.
"P. E. Bound, Switzerland.
"E. Beckmann, Germany."

The best way to make chloride of gold free from excess of acid, is to take, say, one ounce of fine gold, place in a Florence flask, and add 4 ounces of hydrochloric acid, and 2 of nitric acid; place it on a sandbath, and apply gentle heat. When the red flames of nitrous gas cease to rise, pour the supernatant liquor carefully into an evaporating dish, and place on the sandbath. When the liquid assumes a blood-red colour, move the vessel about so as to spread the mass well over the dish, by which means the acid will become more freely expelled. The heat must not be too great, otherwise the gold will become reduced. If this operation be carefully conducted the result will be chloride of gold free from an excess of acid.—*Electro-Metallurgist and Electric Light Journal.*

ART WORK IN THE PRECIOUS METALS.

DAMASCENING.*

BY damascening, is understood the inlaying of one metal into another of a different colour. Iron or steel usually form the ground for this work, and any malleable metal, drawn into very fine wire, can be inlaid into them. Gold and silver are, however, the metals more generally used for forming the ornamentation. These should be unalloyed, as they are then softer, and the wires are the more easily pressed together; also, as it is necessary to warm the work in this process, the metal if alloyed with some other, would show an oxidation upon the application of heat, and the real colour of gold or silver would be destroyed. This inconvenience can be obviated to a certain extent by rubbing out the oxidation with some india-rubber, but the colour would never be so brilliant as it should be; and besides being a long and tedious work, it spoils the dark blue or grey colour that is given to the iron or steel when finished.

The ground is prepared to take the inlaid metal with a sharp flat chisel. With this tool diagonal lines are cut upon the iron, which has first been filed perfectly smooth. After having made these lines one way, they are then cut in the opposite direction, so as to make a number of minute lozenge shape spaces, which form, when the process is finished, very thin blades, and hold the wire in the iron or steel. A wire no thicker than a hair is now taken, of either gold or silver, and pressed into the ground with a burnisher, following the design, which must be drawn on the iron before the lines forming the blades are made. The design for the ornamentation is scratched upon the iron with a sharp steel tool, and must be of a considerable depth, so that its form may not be lost in the after preparation. If the lines of the ornament are to be thick and cannot be filled with a single wire, then two or more wires are applied as close as possible one to the other, and then pressed together. After this the surface is burnished with a larger burnisher than the one before used. This closes all the wires together, and gives it the appearance of one piece of metal; it must in fact seem as if the ornament had been cut of a sheet of a metal, and then applied to the iron. When the work is so far finished, it is heated, so as to dilate the pores of the metal, while warm it is burnished for the last time, and the pressure now given forces the wire into the ground as far as possible.

The following is the process for turning the colour of the iron, or steel, after the work has been completed, to grey or blue. For the grey, the iron is heated over a spirit lamp, the work being moved about so as to have the same heat over its whole surface. When sufficiently hot, which can be seen by water not resting on its surface, put some sulphuric acid over the work by means of a small piece of linen tied on to a stick, of about the size of a pen-holder. After it has remained about thirty seconds, pour some boiling water over the work, in order to obtain the black oxidation, which is produced by the acid. The work should then be wiped dry, and a little oil put over it with a piece of flannel, and then again be held over the lamp for the oil to penetrate into the pores of the iron. If the correct colour is not produced with the first attempt, the operation must be repeated, for it is found by experience that the process has often to be gone through three or four times before the necessary uniform colour can be obtained.

If a blue colour is desired, the iron must be placed upon a charcoal fire and gradually heated, and directly it commences to change colour be immediately taken off, and some oil poured on the work, and rubbed all over with a piece of flannel, so as to obtain a uniform colour, as well as to give it a bright appearance. Then again place the work on the charcoal, and gently heat it, when you have the desired tint, remove the iron from the charcoal, again apply the oil and dry with the flannel, and when cold the process is completed.

This art is practised by but few in Europe. Dufresne is the most celebrated workman in France, and he imitates Persian work to great perfection. This artist executes such work by a process which he has patented. His productions are not well known, as they are not offered for sale, but only parted with as gifts to his friends. In Spain where the Eastern traditions have not yet all been lost, damascened work is produced to a much greater extent, and Zuloaga employs quite fifty hands for manufacturing such objects. Also some of his apprentices have commenced business for themselves, and Zbarzabal has already executed some excellent specimens. In our own country there are probably not more than two or three firms able to produce work by this interesting process.

(To be continued.)

THE NEW INDIA MUSEUM.

THE new Indian section of the Science and Art Department at South Kensington was opened to the public on Monday, the 17th ult. That this exhibition of Indian art treasures will prove immensely interesting to the general public, and most instructive to our workers in every branch of industrial art, is certain; and we should advise our provincial readers, when on a visit to the metropolis, not to forget to bestow a few hours to this latest addition to the attractions of our interesting city.

As we have not yet had an opportunity of visiting the Museum ourselves, we can, for the present, not do better than quote what the *Daily Telegraph* says in reference to the jewellery section. We shall supplement these hasty outlines by fuller descriptions of our own at an early date :—

"From the armoury the visitor passes to the jewellery section—a bewildering display of design and material. But here again it is to the walls rather than the more precious cases in the body of the hall that the visitor should turn for objects of a living interest and fascinating study, for there he will find all the personal ornaments worn by all the races of India arranged in charming groups, and be able to read with the eyes many a picturesque page of our Eastern history —the peaceful India in contrast with the warlike India he has just left behind him in the armoury. From the simple grass bracelets and necklets worn to this day by the wild races, and the leaves which still in places form the only covering of unmarried girls, can be traced the progress of art and gradual civilisation of tribes, culminating in the exquisitely wrought wire-jewellery and gem-studded ornaments which India produces, for the grass is grass still, though it be now of gold, and the maiden's apron of a single leaf is still on the girdle of the robed woman, but it is now of silver, and set, perhaps, with precious stones. Much of the jewellery of India owes its forms to the flower world, and the blossoms of the lotus and the champac, the acacia and marigold, the fruit of various trees and the leaves of many more afford an infinity of shapes of which the sympathetic Oriental has made good use. To what a misty antiquity, again, the 'triple-gemmed' jewel of the Buddhists, and the 'nine-gemmed' talisman of the Hindoos, carry back the student, and what a world of natural wealth is revealed by the glimpses of flower and insect and animal life, given upon the ornaments of India ! But so many of them are already popular in the West, and so many more will be when our goldsmiths and jewellers have learned the lessons which this Indian Museum can teach them, that we need not linger over the anklets, and armlets, and bangles, the rings for fingers and toes, for ear and nose, the toe-studs and head ornaments, the necklaces and bracelets and girdles which are here displayed, besides the innumerable other forms which the Eastern passion for jewellery has adopted for enriching their clothes and sandals and turbans, their weapons and utensils; insignia of office, trappings of horses, elephants, camels, and bullocks, and other articles for which in the West no descriptive word is known, but for each of which to their minutest variety the Oriental has a name. But more than a passing word is due to the wondrous 'Guthrie Collection,' a single case of which is valued at something like a hundred thousand pounds, but of which the contents, the carved and pierced jade plates and boxes, encrusted with precious stones, are virtually priceless. The profuseness of workmanship and wealth is, indeed, almost exasperating; for not content with producing a gem of immense value by intricately carving out a superb block of jade, the workman has in some instances let in plaques of white jade upon the green, and then, after carving this also elaborately, he has gemmed it in mosaic, or bossed it with patterns in emeralds and rubies and diamonds. There are also jade flasks and vases and boxes studded with precious stones, involved in delicate traceries of inlaid gold, or more simply connected by gold lines, in some geometric pattern. A jade bowl, with a lid beautifully engraved, is another treasure of great value; but there are so many such that it is idle work specifying one here and there. The enamels of India cannot, however, be omitted from mention —above all, the wondrous enamels of Jeypore—perhaps the most exquisite form of Indian art—of which there are some fine samples exhibited, and the hookah of silver adorned with transparent enamelling in blues and greens is said by an authority to be one of the finest specimens of the best Mogul period known to collectors. The throne of Runjeet Singh, the lion of the Punjab, is exhibited in this hall; and behind a door, modestly secluded, will be found a plate of gold upon which is engraved a loyal address from the Madras Presidency in 1858, upon the occasion of Her Majesty's assumption of direct government. How it got into the Museum no one knows, and perhaps it is as well that Madras does not know it is there.

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* This most instructive article, from the pen of one of our principal art silver-workers, will be followed by a series of other articles dealing with the most important and most difficult processes of art-work in the precious metals.—ED.

"From the jewellery to silver and metal work is only a step, and the next section therefore is devoted to this extraordinary department of Indian art. Here, indeed, Oriental taste disports itself with unstinted tether, and the result is a wonderful variety of form and substance. Here we have reached the end of the long annexe, and descending a flight of stairs, corresponding with that by which we entered, find ourselves in the department of textile fabrics."

HINTS TO REPAIRERS.

(*Continued from page* 141.)

THE time part of the clock having been repaired, it will be necessary to take a look at the striking part; and this part may be found to be considerably out of order. The method of lifting the hammer is one of importance, and the action of the hammer spring is but seldom right, especially if it be a spring bent over to a right angle at its point. If there are two springs, one to force the hammer down after the clock has raised it up, and another shorter one, fastened on to the pillar, to act as a counter-spring, and prevent the hammer from jarring on the bell, there will seldom be any difficulty in repairing it; and the only operation necessary to be done is to file out worn parts, polish the acting parts, set the springs a little stronger, and the thing is done. But if it be one of the first mentioned construction, some further directions will be necessary, because the action of the one spring answers the purpose of the two in the last named method; and to arrange it so that the hammer will be lifted with the greatest ease, and then strike on the bell with the greatest force, and without jarring, requires some experience. That part of the hammer stem which the spring acts on should never be filed beyond the centre of the arbor, as is sometimes done, because in such a case the hammer spring has a sliding motion when it is in action, and some of the force of the spring is thereby lost. The point of the spring should also be made to work as near to the centre of the arbor, as it is possible to get it, and the flat end of the spring should be at a right angle with the edge of the frame; and that part of the hammer stem that strikes against the flat end of the spring should be formed with a peculiar curve that will stop the hammer in a particular position, and prevent it jarring on the bell. This curve can only be determined by experience; but a curve equal to a circle six inches in diameter will be nearly right. The action of the pin-wheel on the hammer tail is also of importance. The acting face of the hammer tail should be in a line with the centre of the pin-wheel, or a very little above it, but never below it, for then it becomes more difficult for the clock to lift the hammer, and the hammer tail should be of such a length as to drop from the pins of the pin-wheel and, when it stops, be about the distance of two teeth of the wheel from the next pin. This allows the wheel-work to gain a little force before lifting the hammer, which is sometimes desirable when the clock is a little dirty. We might also mention that in setting the hammer spring to work with greater force, it is always well to try and stop the fly with your finger when the clock is striking; and if this can be done it indicates that the spring is stronger than the power of the clock can bear, and it ought to be weakened, because the striking part will be sure to stop whenever the clock gets the least dirty.

The repeating work, and that part of the mechanism that regulates the number of blows to be struck on the bell, may be in disorder, and worn in some parts. The rack, which must be considered as the segment of a wheel, should have its first tooth a little longer than the others, so that the other teeth will not grate on the point of the rack catch, and make a disagreeable noise when the clock warns before striking.

The "tumbler," or gathering pallet, that works into the teeth of the rack, will be very likely to be split or worn out. The figure 6 is a good model to make a new one after, and it should be made so as to lift one tooth and a very little of the next one at each revolution. It is necessary to cause the tumbler to lift a little more than one tooth, and let it fall back again, to insure that one will always be lifted; because if such was not the case the clock would strike irregular, and would also be liable sometimes to strike on continually till it ran down. If the striking part is locked by the tail of the tumbler catching in a pin in the rack, the tail of the tumbler should be of such a shape that will best prevent the rack from falling back when the clock warns for striking the next hour, and of course the acting faces must be perfectly smooth and polished. A guard pin ought to be put in the frame, if one does not already exist, to prevent the rack from going farther back than is necessary for it to strike twelve o'clock; for sometimes, when the clock runs down, and the striking part happens to run down first, the rack-arm rides on the snail on the hour-wheel, and the teeth of the rack are then in some instances allowed to go out of reach of the tumbler, and when the clock is wound up, of course it will keep on striking till it runs down, or the weight is taken off, or the rack again put in action.

(*To be continued.*)

MALLEABLE BRONZE.—Mons. Dronier has patented in Germany a process for rendering bronze as malleable as copper. About 1 per cent. of mercury is added to the tin in a warm state, and this is then mixed with the melted copper.

A FEW WORDS ON GEMS AND PRECIOUS STONES.

By Edward J. Watherston, F.S.S.

The singular fascination attending gems, or precious stones, and the extraordinary high value set upon them, is one of the most curious facts in the history of mankind. It cannot be rationally explained. In themselves the so-called precious stones are valueless, or nearly so. Excepting the diamond, ruby and garnet,* they serve no earthly purpose of usefulness; and yet they rank among the highest and most coveted of worldly possessions. How came this to be? The answer is threefold. Originally, in the dawn of history, as far as our eye can see back into it, gems were considered magical objects, or "charms," protecting the wearer against all sorts of mundane evils, including illness; next, by a slight transition, denoting however considerable progress, the gems were simply believed to be medicinal agents, but unique in their kind, and of inestimable value as such; and, finally, by a further transition, leading up to our own days, the gems were, by nearly universal consent, adopted as the highest expression of accumulated riches. There was something like an economical necessity in this modern appreciation of gems. With the advance of commerce and industry, and the attendant growth of wealth, men felt the necessity of possessing, so to speak, concentrated expressions of earned or hereditary riches. Gold and silver did not suffice. The possessor of a million wants a big ship to carry his treasure in the shape of gold; while in the shape of diamonds and rubies he can carry his million in the hollow of his own hand, or hang it around the neck of his wife.

Gems as "Charms."

The belief in gems as being endowed with the most marvellous powers, ridiculous as it may seem to the modern mind, was in reality a legitimate offspring of what has been not inappropriately called "natural" religion. Looking around him, and above him, through the universe, dim to his eyes, man first of all perceived that while the mass of objects on earth were the same occurring in masses, there existed a few things that were very rare. And among the rarest of rare things were the precious stones. But they were not only found in small quantities, and of the most diminutive size compared with other things, but they had peculiar forms, with a lustre of their own resembling that of the stars. They were unlike all other substances found under and above the earth. It was quite logical that they should be considered before all things "precious," specially created by supernatural powers, and endowed as such with supernatural virtues. The belief, originating probably in India, the cradle and first home of all gems and precious stones, spread rapidly through the ancient world, as recorded among others in many passages of the Bible. Thus we are told, in the eighteenth chapter of Exodus, that gems were an indispensable adjunct in the attire of the High Priest. "And thou shalt put in the breastplate of judgment the Urim and the Thummin; and they shall be upon Aaron's heart, when he goeth in before the Lord: and Aaron shall bear the judgment of the children of Israel upon his heart before the Lord continually." It is probable that the "Urim" and the "Thummin" were large diamonds, although Epiphanius, the early Christian bishop and learned historian, describes them of a sky colour, and they, therefore, may have been sapphires, valued equal to diamonds in ancient times. According to Epiphanius, the Urim and the Thummin in the "breastplate of judgment" of Aaron were endowed with special virtues, for "the change in the colour of them, when he came out from the sanctuary, manifested the favour or anger of Jehovah."

Josephus, the famous Jewish writer, governor of Galilee not long after the death of Jesus Christ, is still more explicit in regard to the wonderful gems adorning the High Priest. In his "Antiquities of the Jews," Josephus says that the successors of Aaron were "armed" with twelve magical jewels. "I mean that which was in the nature of a button on his right shoulder, bright rays darting out thence, and being seen even by those who were remote, which splendour yet was not natural in the stone. This has appeared a wonderful thing to such as have not too far indulged themselves in philosophy, so as to feel contempt for divine revelation. But I must speak of what is still more wonderful. God declared beforehand, by these twelve stones which the High Priest bore on his body, and which were inserted into his breastplate, at what times the Jews should be victorious in battle. For so great was the splendour shining forth from the stones at such times, when the army began to march, that all the people became convinced at once of fighting under the assistance of God. Whence it came to pass that such Greeks as had a respect and veneration for our laws, possibly because they could not disprove them, called the High Priest's breastplate the 'Oracle.'"

Not only the natives of India, the Egyptians, the Jews, and other nations of ancient history, had full faith in the occult power of gems, but even the highly cultivated Greeks believed in it. The Greek trust in the wonder-working power of precious stones is expressed in numerous works of their classical writers, and stands forth strikingly in the, to Greek scholars, well-known "Ode on Gems," by the national singer Orpheus. In this poem, of about eight hundred pages, a list is given of all the precious stones known to the Greeks, and the supernatural qualities ascribed to each of them. Orpheus calls gems in general "the highest gift of Jove to mortals," bestowed upon them as "a sure remedy against all earthly woes." All precious stones, says Orpheus, are hidden by the gods underground, "in mystic caves," and whosoever can discover them will be rewarded by "endless blessings;" to the possessors "care and sorrow will be unknown, as well as illness, and they will always obtain victory in battle." Coming to specify the virtues of each individual gem, Orpheus advises that "if thou wearest a piece of the agate stone on thy hand, the immortal gods will ever be pleased with thee; and if the same be tied to the horns of thy oxen when ploughing, or round the ploughman's sturdy arm, wheat-crowned Ceres will descend from heaven with full lap to throw it upon thy furrows." Of the ruby Orpheus says: —"From off the altars thou, like the crystal [garnet or carbuncle] dost send forth a flame without the aid of fire;" and of the topaz: "Adorned with it man may gain at once the heart of every woman, and woman the heart of every man." Happy Greeks! The acquisition of a topaz must surely, among them, have made the course of true love to run for ever smooth.

(*To be continued.*)

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* For the respective trades of glass-cutting and watch-making.

Over three million five hundred thousand pounds' worth of diamonds were exported from the Cape last year.

A good material for protecting parts of an article not required to be gilt may be made by melting good yellow resin (not French) 5 parts, beeswax 3 parts, red sealingwax 2 parts. Melt the resin and sealing-wax together, and then add the beeswax. When the mass is fluid, stir in about 1½ parts jeweller's rouge. The mixture should be stirred until quite set. Chrome yellow or washed crocus may be used in place of the rouge.

THE ART OF THE SILVERSMITH.

By W. Herbert Singer.

(*Continued from page* 133.)

NO two events, probably, caused such a complete revolution in the world of art, and therefore in the design and execution of every kind of metal work, as the conversion of Constantine to Christianity, and the removal in the year 330 of the seat of government to Constantinople.

There can be no doubt but that the former of these events gave a great impetus to the art of silver working, and caused a great demand for such work, as, besides the costly gifts Constantine bestowed upon Roman churches, he endowed those of Constantinople even more magnificently. No sooner had the emperor embraced Christianity than he endeavoured to do honour to his new religion by making her temples and their contents as gorgeous and costly as possible, and his zeal must have been indeed great, for, in a very few years, Constantinople became the richest city in the world, and this was mainly due to the service of the Church.

It is most unfortunate that the writers who chronicle these riches do not give sufficient particulars concerning them to enable us to form an idea of their artistic merit; but, from the fact of the size and weight of the various objects being stated, we may conclude that the intrinsic value was more considered than beauty of form or delicacy of ornament.

The works now executed were probably debased copies of classical examples, for, as yet, little progress could have been made in the new art. The form, as being more difficult to invent, we must suppose was a more or less direct imitation of the older style, while the Christian artist would endeavour to change the detail upon it so as to make his production more consistent with its fresh service. The example set by Constantine was followed by his successors, each emperor striving to add some new splendour to the Eastern capital.

So late as the tenth century Constantinople held the proud position formerly belonging to Rome, and from her came the light that dispelled the darkness over the rest of Europe; and if it was not so high and beautiful an art as that emanating from the ancient mistress of the world, it was, at least, a strong, vigorous style that has retained its influence, even down to the present day.

The whole secret of the difference between the two styles lies in the fact that, as the Greeks especially cultivated beauty and purity of form, the Byzantine artists sought above everything beauty and richness of colour. This is particularly observable in studying the gold and silver work belonging to these periods.

In the great eras of art these metals were used in their native state, and the forms into which they were worked were so beautiful that they required no further help to make them perfect works of art. But this did not satisfy the more gorgeous, but less refined, taste of the lower Empire, and these artists were not content unless their metal work was resplendent with sparkling effect. This luxurious people delighted in splendid masses of colour; this they often obtained in their work by precious stones, grouped together without any regard to design, but the effect of colour. It was for this reason they brought enamelling to such perfection. The rudiment of the art they no doubt obtained from the East, where the enamel was applied to the metal in a thin layer by vitrification. But the Byzantine artists were the first to practise, in Europe, the art of *cloisonné* enamel, by which process each colour is separated from the other by a thin strip of metal.

We must not pass from this early period without making mention of the important specimen of silversmith's art which has come down to our own time. I refer to the altar frontal in the church of St. Ambrose, at Milan. It is of silver, partly gilt, and in it are set, in great profusion, precious stones and plaques of enamel. It was the gift of the Archbishop, in the year 835; being a peace offering from him, to atone for the profanation of the relics of St. Ambrose, of which he had been guilty. Some attribute this work to Lombardian, and others to Byzantine origin, but its whole character seems to tend towards Latin art. It is, without doubt, one of the most important objects created by Christian art up to the year 1,000.

There can be no doubt, however, that another most elaborate work of this age was created by Byzantine artists. I refer to the gorgeous altar frontal in St. Mark's, at Venice. This example is the finest specimen of the enameller's art that has been handed down to posterity.

The tenth century was, for Europe, a most disastrous period; war was so general that the people had to study the use of a harder metal than silver. The general expectation of the end of the world, at the completion of a thousand years from the birth of Christ, was another cause of the gloom and apathy which now depressed the whole of the West.

The eleventh century was a period of renovation. Romanesque is the term given to the art of this transitional period, which may be said to connect ancient art with the Gothic style. Now was commenced that movement which afterwards developed the beautiful forms of the thirteenth and fourteenth centuries. Artists were now tired of seeking for the traditions of the antique; they therefore created new shapes, and their art was gradually moulded into that severe style so pre-eminently ecclesiastical, which retained its hold upon the people until the era of the Græco-Roman style, 400 years later.

Towards the end of this century, and throughout the succeeding one, a large number of shrines were made; they are, in fact, the characteristic object of the age. They probably sprang up in such numbers from the quantity of relics brought home by the Crusaders, when the want was naturally felt for a receptacle worthy of such holy treasures. The shrine is almost always made in the form of a coffer, the framework of which was wood, a sloping or gabelled top, overlaid with thin plates of silver or gold. The sides generally consist of a series of arches, within which are placed statuettes. The arcading is enriched with *cloisonné* or *champlevé* enamel, filagree work, or is set with precious stones. The figures are executed by *repoussé* work, in rather high relief, the head being, as a rule, quite detached from the ground. These figures have no longer the supple grace with which the lost style would have endowed them; they are now stiff and gaunt, each posing in a certain solemn grandeur under its rounded canopy.

(*To be continued.*)

A Very Rare Gem.—The Prussian capital, it appears, has long contained a jewel of quite fabulous value, although the news of its existence was first made known to the general public by the reports of the last session of the Polytechnic Society. This noble stone is a sapphire, and is the property of one of the members of that learned body. It weighs "12⅛ loth"— a little more than six ounces. The jury of the Polytechnic Society have settled its value at the frightful sum of 64,000,000 marks, or £3,200,000 of English money. It need hardly be said that such a treasure is not very likely to find a purchaser at such a price. It is contended by some of the adepts that the stone is not perfectly pure; but it can never be so far lowered as to tempt the richest and most eccentric collector in the world to give anything like the sum which must be asked for it.

TECHNICAL EDUCATION.

APPRENTICESHIP: SCIENTIFIC AND UNSCIENTIFIC.

By Silvanus Phillips Thompson, D.Sc., B.A.,

(*Continued from page* 148.)

Nor are private firms alone in thus providing something towards remedying the evils of the decayed apprenticeship system. There is in Paris an excellent school of applied art, holding evening classes at 339, Rue St. Martin, established by the Syndical Chamber of Jewellers and Goldsmiths, for the apprentices of the different firms represented in the chamber. From the point of view of the application of art to the particular industries named, the success of this school is remarkable. Some of the designs for jewellery, executed by pupils of the school, are extremely elegant and artistic. I have been told by M. Gréard, the late Director of Primary Education for the Department of the Seine, and now Vice-Rector of the *Académie*, that, at first, the Trades' Unions of Paris looked askance on the establishment of such schools; but finding the real substantial benefit that accrued to the industry as time went by, they have come round to recognise their value, and that some of them have even started schools on their own account for the apprentices who are sons of members of the Union. The *Chambre Ouvrière des Bijoutiers*, for example, has set up an evening school for art-teaching in the Quartier du Temple.

In Germany and Switzerland there are also excellent trade schools and technical evening schools, approaching in character those with which we have just been dealing, though they are usually organised on a somewhat wider basis. Many of the *Fortbildungs-Schulen*, *Gewerbliche Fortbildungs-Schulen*, and *Handels-Lehranstalten* are technical schools of a lower grade than the *Polytechnikums*, established chiefly for the benefit of apprentice boys, and afford an excellent supplementary education. The vast array of *Gewerbe-Schulen*, or trade schools, to be found in every German town of importance, testify to the universal recognition in that country to the need of adapting the education given to the artisan lad to the special needs of his future career. In many of these schools no doubt the teaching is excellent; but I have seen enough of them to know that they are often inefficiently provided with teachers. Nevertheless, the amount of good effected on the whole by these schools must be enormously great. And when we contrast the abundance of technical instruction, higher and lower, thus provided in Switzerland, France, Austria, Belgium, and in every province of the German Empire, with the utter absence of it at home,* it is impossible to avoid endorsing the opinion of Professor Huxley, that "The condition of England in these matters is simply scandalous." Such schools are destined to play a very important part in the industrial competitions of the future; and they have begun to make their mark. Thus the Horological School of Besançon played a considerable part in the movement, which has, within the last fifteen years, wafted nearly half the watchmaking industry across the Juras from Switzerland into France. In ten years (from 1864 to 1874) the Swiss importations into France fell in value from four millions of francs to one million and a-half, while the French importations into Switzerland—I am speaking of horological imports, of course—rose from less than four hundred thousand francs to over a million and a-half. The Swiss, seeing their trade forsaking them, immediately re-organised their three horological schools, and established three new ones; and I doubt not time will show the large wisdom of this step. The watchmaking industries of Clerkenwell and of Coventry are at a very low ebb, and a great deal of the best work purporting to be English is really imported from the Continent to be worked up here. Why cannot we, too, reorganise this ancient industry and regain our former prestige? Why do we not have a school of art metal-work in Soho or Clerkenwell, or a school of cutlery at Sheffield, to help us to fight the importation of tools, scissors, and other articles that America is sending into our markets? We have seen in Lambeth how a school of art may afford the most splendid aid to the revival of a lost art, or, rather, to what is almost the creation of a new one. Many a little local industry now dying of inanition, or confined within narrow limits, might thus assert a prosperous existence, or extend its operations far beyond their present range. Surely there is room for a school of jet-cutting at Whitby, and if the jet workers need an example to stimulate them there is one provided by the recent establishment of a school of coral-cutting at Torre del Græco, whose art products have, until quite lately, been as local as the art products of Whitby.

I have now reviewed, and that all too briefly, a few of the institutions in which an attempt is made to provide a rational and scientific apprenticeship in the handicraft trades, and there still remain several considerations, amongst which the foremost is how we are to obtain for English skilled artisans the benefits of the systematic training which so many of their foreign compeers enjoy, and which goes far towards making their apprenticeship a rational and scientific one.

(*To be continued.*)

Enamelling on Brass and German Silver.—The adhesion of enamel to brass and German silver, it is said, may be most perfectly effected by first engraving or impressing the design to be enamelled into the alloy, and then *coating the whole object*, or only the depressed design, *galvanically with copper*. The enamel can be *fused* on this surface as usual, and may then be bronzed, silvered, or treated in any ordinary way.

Two Tons of Silver per Week.—There are five establishments in the United States where the smelting and refining of silver-bearing lead ores is carried on. One of the most extensive, if not the most extensive, of these works is that of the Pennsylvania Lead Company, of Pittsburg, Pa. Here the "base bullion" of Leadville and of Utah is brought to meet the cheap coke and coal of Pennsylvania, and though the freight per car averages 300 dols., the business has grown to great proportions. President Schwartz, of the above company, gives figures showing that 60 per cent. of the "base bullion" output of Leadville is shipped to the Pittsburg refining works, besides 75 per cent. of the output of Utah lead mines. "Base bullion" is the product of the ore smelters of the mining regions, and bears about the same relation to refined silver as pig metal to refined steel. At the Pittsburg refining establishment this "base bullion" is converted into lead, silver and gold. The precious metals find their way to New York, while the lead is consumed by the makers of white lead. The Utah ores are the richest in gold, sometimes reaching 40 ounces per ton. Of silver, the Pennsylvania lead company ships 50,000 ounces per week, or two tons, representing in value, at 1 dol. 14 cents per ounce, 57,000 dols. This metal leaves the works in pretty bars of 2,000 ounces each.—*Scientific American.*

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* The only trade school of any mark in England is the excellent trade school of Bristol, founded by the late Canon Moseley. Our Schools of Art have done much, but might do much more. Our Science schools and classes are, as I have pointed out elsewhere, lamentably deficient and cramped in usefulness by the arrangements of the Science and Art Department, and the teaching in them and the method of remunerating that teaching require radical re-organisation. There are a few other admirable institutions, such as the Artisan Institute, Castle Street, St. Martin's Lane, and the Birkbeck Institution. The Technological Examinations of the Society of Arts, and more recently of the City and Guilds Institute, have begun to do a good work. The classes of applied chemistry and applied physics recently organised by the Guilds' Institute, at the Cowper Street Schools, are another step in the right direction. But why do we not have scores of similar classes in every industrial centre?

CONTENTS OF VOL. VI.

A.

PAGE
Abuses in the American Jewellery Trade .. 66
A Few Words on Gems and Precious Stones, by *E. J. Watherston* 16, 30, 42, 79, 103
A Handy Way to Replace a Worn-out Square on a Winding Arbor 18
Aluminium .. 22
Aluminium Pen and Pencil Cases .. 138
A Monster Diamond .. 108
A New Watch Crown .. 3
Argentine .. 40
Artificial Production of Diamonds .. 4
Art Works in the Precious Metals, by *W. H. Singer* .. 27, 51
Awards at the Melbourne Exhibition .. 142, 159
A Watch Wound up by Electricity .. 2

B.

Bailey's Hot-Air Engine, Illustrated .. 5
Book Notices .. 41, 61, 75, 127, 151, 156
Brittleness of Emeralds .. 17
Bronzes, by *C. D. E. Fortnum* .. 44, 45, 120, 135, 151

C.

Caution .. 18
Cheap Clocks .. 13
City Guilds of London Institute .. 48, 63
Clock wanted in Clerkenwell .. 16
Composite Diamonds .. 30
Compulsory Hall-marking .. 140
Construction of Timekeepers: delivered to the Board of Longitude, March 7th, 1805 .. 85, 104, 105, 133, 152, 168
Coral .. 7
Corundum Mines, Macon County, N.C. ..
Crown Jewels of France .. 83, 84
Crystallized Silver .. 17
Curiosities of Clocks and Watches .. 160

D.

Depthing, by *Albert Johann*, Illustrated .. 75
Diamond Fields of Griqualand West, by *R. W. Murray* .. 136, 137
Diamonds in New York .. 64
Discovery of Gold Coins and Plate .. 19

E.

Enamelling .. 102
English Machine-made Railway Watches .. 94
Exhibition of Watches, Tools, &c., at Chaux-de-fonds .. 122
Expansion of Metals .. 16
Exports of Watches and Musical Boxes from Switzerland to the United States, from 1864 to 1880 .. 124
PAGE

F.

False Turquoise, by *Bryce-Wright* .. 29
Fashion in Jewellery .. 49
Fire-Gilt Alberts and Bracelets .. 7
Flashing in Assays of Gold, and on the Influence of the Metals of the Platinum Group on it .. 21, 22
Flexible Shafting for Tower Clocks .. 124
Forged Hall-marks .. 15, 97
Free Trade in Gold and Silver Plate .. 6, 7

G.

Gilding Solution .. 41
Gold Casket for the King of Greece .. 103
Gold in Cornwall .. 92
Gold in South Africa .. 7
Goldsmiths' Company .. 33, 34
Goldsmiths' Company *v.* Currey .. 62
Goldsmiths' and Silversmiths' Free Trade Association .. 8, 15
Goldsmiths' Company's Prizes .. 101
Greenwich Chronometer Trials .. 64

H.

Hall-marking .. 52, 86, 25 119, 120
Hall-marking in America .. 52
Hall-marks and Trade-marks, by *J. U. Poole* .. 4
Hard-soldering Wedding Rings by *H. Bush* .. 36
Hints to Repairers .. 8, 18, 28, 45 127
Horological Institute .. 5

I.

Imitation of Old Silver .. 18
Imitation Waltham Watches .. 127
Improved Patent Musical Boxes, Illustrated .. 66
Improved Watch-case Spring .. 159
Industrial Training, by *An Old Technologist* .. 137, 138, 153
International Exhibition of Watch Tools, &c., at Geneva .. 5

J.

Jewellery, Silver & Electro-plate at the Melbourne Exhibition 121, 122
Jewellery Trade of Pforzheim, Germany, by *H. Bush* .. 152, 153

L.

Letters to the Editor 4, 14, 15, 26, 27, 39, 41, 52, 53, 59, 60, 71, 72, 73, 90, 111, 123, 124, 139, 140, 149, 155, 156, 163
Lincoln Cathedral Clock .. 101
Liverpool Cathedral Plate .. 100
Luminons Paint .. 39

CONTENTS.

M.

PAGE

Machine Work *versus* Hand Work, by *J. U. Poole* 41, 53, 59, 60, 71, 72
Machine Work *versus* Hand Work: A Reply to Mr. J. U. Poole, by *Richard Whittaker* .. 73, 74, 89, 90, 107, 108, 125, 141, 142, 157
Müller's Chronometer Escapement 29, 53, 100

N.

New Winding Mechanism, by *E. Wright* 40
Nickel-Plating by Boiling 95
Novelties in Table Ware. Illustrated 82, 83

O.

On Soldering and Melting, by *H. Bush* 95
On the Fluctuations in the Relative Values of Silver and Gold, by *E. J. Watherston* 54, 65, 102, 134, 160, 168, 169, 170
Origin of the Diamond 69
Our Tools 7

P.

Pearl Fisheries in Ceylon 150
Pearls in New Zealand 15
Pebbles 77
Permanent Exhibition of Watches, Clocks, Musical Boxes, and Jewellery at Geneva 32, 33
Practical Instructions to Jewellers, Silversmiths, and Electro-Platers, by *A. Roseleur* 3, 13, 25, 37, 49, 61, 76, 91, 109, 128, 129, 144, 161
Precious Specimens of Coral 52
Presentation to the King of Greece 5
Present to the King of Siam 62
Prizes for Art Workmanship 72
Property of the Guilds of the City of London 51

Q.

Quacks in the Trade 13
Queries and Answers 43, 48, 81, 90, 113

R.

Reform of the Patent Laws 129
Registration of Trade Marks and Designs in Italy 15
Repairing Swiss Watches, by *H. Ganney* 38, 39, 50, 62, 82, 94, 112, 113, 148

S.

Sapphire Mines of Siam 34
School of Horology, Glashuette 29
Silver Plating 101
Silver Trade, by *An Old Hand* 14, 15, 26, 27, 39
Sir John Bennett 52

PAGE

Soft Pinions, &c., by *J. D. Fisher* 163
South Kensington Museum 64
Specimen of Horological Art 58
Spinel Crystals 25
Statistics from the Birmingham Assay Office 64
Statistics of the Silver Trade 60
Substitute for Gold Bronze 22

T.

Taxation of Gold and Silver Plate, by *E. J. Watherston* 74
Taxation of Silver Plate 40, 74, 149, 159
Technical Education, by *S. B. Thompson* 10, 17
Technical Instruction to Watch and Clock Makers, with Thirty Woodcuts, by *I. Herrmann* 56, 57, 68, 69, 80, 81, 98, 99, 114, 115, 130, 131, 146, 147, 164, 165, 166
Testing Coin at the Royal Mint 8
The Application of Handwork, by *J. U. Poole* 123, 124, 139, 140, 155, 156
The Art of the Silversmith, by *W. H. Singer* 20, 21, 58, 70, 86, 87, 122
The Clockmakers' Company's Library 111
The Construction of a Simple but Mechanically Perfect Watch, by *M. Grossmann*, Illustrated with Twenty-three Woodcuts 9, 19, 31, 43, 55, 67, 78, 92, 110, 111, 126, 126, 127, 143, 158, 159
The Discrimination and Artistic Use of Precious Stones, by *Professor A. H. Church* 154, 166, 167
The Goldsmiths and their Discipline 113
The Jewellery Trade of France and Germany 103
The Manufacture of Jewellery in Providence, U.S.A., by *H. Bush*, 28, 29, 46
The One Mechanic Buried in Westminster Abbey .. .. ..
The Queen's Plate 69
The Value of Hall Marks 7
The Various Arrangements of the Barrel and Barrel Arbor, Illustrated with Ten Figures, by *F. Rosenkranz* .. 96, 97
Time Work and Time Signals at the Greenwich Royal Observatory, by *C. Stuart Murray* 1, 2, 11, 12, 23, 24, 35, 36, 47, 48
To Make Chloride of Gold and Nitrate of Silver, by *H. Bush* .. 77
To Polish Aluminium 103
To Render Ivory Flexible 111
Tracing the Pendulum 118
Trade Catalogue 51
Trade Notes: A Summary of Events in the Trade at Home and Abroad 132, 148, 149, 162, 163
Trustworthy Watch Repairers 7
Turners' Company Prizes 48

W.

Watches at the Melbourne International Exhibition 113
Watchmaking, by *E. Rigg, M.A.* 116, 118
Wedding Presents 103
Where to Buy a Clock 18
Whitby Jet Trade 62

THE WATCHMAKER JEWELLER AND SILVERSMITH'S TRADE JOURNAL.

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CONTENTS.

52,742

	PAGE
The Time Work and Time Signals of the Greenwich Royal Observatory	1
Practical Instructions to Jewellers, Silversmiths and Electro-platers	3
Hallmarks and Trade Marks	4
British Horological Institute	5
An Engine without a Boiler	5
Free Trade in Gold and Silver Plate	6
Fire-Gilt Alberts and Bracelets	7
Our Tools	7
Gold in South Africa	7
Hints to Repairers	8
Testing Coin at the Royal Mint	8
The Goldsmiths' and Silversmiths' Free Trade Association	8
The Construction of a Simple but Mechanically Perfect Watch	9
Technical Education	10
Patents	i
Monthly Record of Bankruptcies	ii
Directory	iv
Advertisements	i—xii

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THE TIME WORK AND TIME SIGNALS OF THE GREENWICH ROYAL OBSERVATORY.

By C. Stuart Murray.

In March last Mr. G. L. Criswick, F.R.A.S., delivered a most able and interesting lecture at the British Horological Institute, Northampton Square, upon the system of the Greenwich time signals. As the lecturer is also a member of the Society of Telegraph Engineers, his story was fully illustrated by large diagrams and drawings of the mechanism and wires connected with his subject. An abstract of this lecture was afterwards published in the official journal of the Institute, but upon going carefully over it we found that the treatment was far too technical for all but readers well acquainted with the scientific side of telegraphic art in working combination with practical horology. Such being the case we decided to go over the same ground in a more popular way, adding things that were not necessary to the lecture, and leaving out others that are not necessary to the reader. Accordingly by the special permission of the Astronomer Royal, for which we most sincerely thank him, we duly found ourselves under the great time-ball. Mr. Criswick was there, and very kindly placed his valuable aid at our disposal. Before, however, we proceed on our main errand, we will offer a short introductory preface for the purpose of better enabling the reader to comprehend what is to follow.

First and foremost, then, before time can be signalled it must be "made," and the Royal Observatory at Greenwich is the place, beyond excellence, where the manufactured article can be turned out in the most perfect manner known to civilisation, especially to the highly cultured civilisation of nautical astronomy. The ever-lauded ancient world had no such "machinery" for the production of hours, minutes, and seconds as we have. The Babylonians, the Chaldeans, the Greeks and Romans knew nothing of our "tools," nor did our own early Saxons. Even the Chinese and Hindoos, who are supposed to have had the first knowledge of everything, were in no better condition. Egypt, comparatively enlightened as it undoubtedly was, stood in the shadow of ignorance in this respect. What would Hipparchus, Ptolemy, Meton, Thales, Aristotle, and all the ancient host have given for a sojourn in Flamsteed's old house on the hill of Greenwich Park? Thales, Pythagoras, and Archimedes would have been beside themselves with joy. The immortal godfathers of the constellations were in a "darkness visible" that we never knew; still they were astronomers. Does not the dramatic poet, Euripides, make the chorus in one of his tragedies say, "What is the star now passing? The Pleiades show themselves in the east. The eagle soars in the summit of heaven."

From the time that astronomy came into Europe in the 13th century until now, what an army of time-makers there has been. It may not be known beyond learned circles that old Waltherus, the pupil of Regiomontanus, has the credit of being the first astronomer who used a clock in his observations. But what a clock it must have been, that "regulator" of the closing years of the 15th century! It could hardly have been much better than the Clepsydra of Ctesibius, with the hours spirally marked upon the column, one cupid dropping tears to supply the water-wheel that moves the wheelwork concealed in the base, and another cupid rising on the back of the dolphin, marking with the arrow in his hand the hours as he passes them. An important period in the history of time-making may be said to be comprised between the death of Tycho Brahé, in 1601, and that of Sir Isaac Newton, in 1727; and from the latter date to the foundation of the Royal Astronomical Society, in 1820, embraces another. But in this country there were students of the stars previous to the conquest; for instance, there were Adelin, about the year 680, Walfred Ripon, 698, Bede, 730, and others. How few of the long array of names that could be given knew the ABC of their science as it is known now. They had no perfect transit instruments, no equatorials, no sidereal and no solar clocks, and yet how they plodded on in their allotted paths with the poor means at their command. Their time signals were from the sun, the moon, and the stars, as they are now, but the world had either to go or to send to have those signals read. The electric telegraph was to them in the womb of the far distant future.

"Time," says Laplace, "is to us the impression left on the memory by a series of events, the existence of which we are sure was successive. Motion is suitable to serve as a measure for it, because a body not being capable of being in several places at once, incapable of ubiquity, must in passing from one place to another occupy successively all the intermediate parts. If at each point of the line described it is animated by the same force, its movement will be uniform, and the portions of that line may measure the time employed in traversing them."

This is a correct definition, indeed, from the author of the celebrated "Mécanique Celéste." Such was to be expected. Laplace was a mathematician first, and a Frenchman afterwards; and, although his name seems far removed from us in our memories, he lived until the year 1827.

Having stated what time is, we will next explain how it is made and how it is distributed.

Every place has a meridian—that is, an imaginary line directly overhead from north to south, which the sun passes in his daily course. It is the highest point reached by that luminary, and in daily life always indicates noon. The English meridian is fixed as over the Greenwich Observatory, and as from it all the calculations for the Nautical Almanac are based, it may be practically taken to be the world's meridian for navigating purposes. That being so, any place that is either east or west of this line is so much before or after the noon of Greenwich. Furthermore, this before or after noon is called in the language of nautical astronomy east and west longitude, or *length* from the place above named. From what has been said it will be readily understood that time and distance from a given meridian are convertible terms, hence a knowledge of their relationship to each other is indispensable for the conduct of the affairs of mankind. The earth being a globe has a number of imaginary circles given to it; but they are only imaginary to *sight*, for their positions are well known and defined by astronomers. Thus there are circles of latitude and circles of longitude, both celestial and terrestrial. The circles of longitude are meridians, and the other circles at right angles to them are circles of latitude. It is to be noted that every terrestrial circle has its corresponding celestial one. The celestial meridian passes through the celestial poles and the highest part from the horizon of the place it passes over, whilst the terrestrial circle passes through the terrestrial poles of the earth and the earth itself. As longitude means length, latitude, from *latus*, broad, means breadth. But the circles of latitude have no meridian, their starting line being the equator, the greatest of all the terrestrial circles. This circle is supposed to cut the earth into two equal hemispheres, the circles on each side of it going north and south. Hence we have the terms north latitude and south latitude. The meridians of longitude deal with both time and distance, whereas the circles of latitude deal with breadth or distance only; that is, distance on each side of the equator.

A meridional line cuts through every one of latitude, until after going round the world it returns to the place of rest and so completes the circle. In proof of this it may be mentioned that the meridian of Greenwich passes near the town of Cambridge, through Louth, in Lincolnshire, about two degrees east of Aberdeen, a little east of the Shetland Isles, and away across the Arctic Ocean to the north pole. Now, all the places directly under it have precisely the same time as Greenwich, for when it is noon at the Royal Observatory it is noon with them. Going south, the line leaves England at Lewes, in Sussex, enters France by the mouth of the Seine, on by Havre and Bordeaux, across the Pyrenees by a small Spanish village named Luz, where it enters Spain, then along the provinces of Arragon and Valencia, crossing the Mediterranean, east of Gibraltar, through the great Desert of Sahara, across Africa to the Gold Coast, by the Gulf of Guinea, and so on to the equator. Here, too, all the places under it in this direction would have the same time as Greenwich. The line after crossing the equator goes down near New Zealand, through the south pole, up the Great South Pacific Ocean, across the Northern Pacific and back to Greenwich again. If it were possible to take a chronometer set to mean time here along this line, it would be found to agree with the mean time noon of all the places that it passed away to the equator. If Mr. Criswick, therefore, had his wires laid on, he could fire guns and drop time-balls for all of them, as far as the equator. On the other side of that circle they are in the eastern hemisphere, and our daylight does not travel so far; they have to wait, or rather we have to wait, being westward of them, for our share every day.

Having thus spoken of the circles of latitude and longitude, which are the foundations of the making of time, we must not omit to mention that these circles are divided into 360 equal parts called degrees. Many working astronomers have expressed regret that, upon the revival of learning in Europe, the decimal scale was not adopted, as it would have greatly facilitated their computations. The 360, although not decimal, are divisible by 2, 3, 4, 5, 6, 8 and 9; yet it was argued in the last century that the decimal notation would have been the best.

(*To be continued.*)

The demand is made that the great City Guilds should establish permanent, easily accessible, and exhaustive collections of manufactured articles appertaining to the various trades, of which they are in some measure presumed to be the representatives.

M. L. Sonderberg, watchmaker, of Copenhagen, has constructed a clock which is wound up by the aid of an electric battery. An electro-magnet keeps a spring in tension, and thereby secures the constant motion of the clock. It is said that a clock can be made to go in this manner for about a year, and all that is needed is to look after the elements once or twice during the whole time.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTROPLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. XV.

(*Continued from page* 151.)

Brass Bath for Zinc.—

Soft or rain water, 4½ gallons;
Bisulphite of soda, 24½ ounces;
Cyanide of potassium, No. 2, 34 ounces.

To this solution add—

Water, 9 pints;
Acetate of copper, 12½ ounces;
Protochloride of zinc, 12½ ounces;
Ammonia, 14 ounces.

The filtered bath is colourless, and gives, under the action of the battery, a brass deposit of a very fine shade. The tint varies from red to green, according to the proportion of copper or that of zinc. The anode is of brass.

The difficulty in brass electroplating, especially with small baths, is in keeping the uniformity of the colour of the deposit, as the galvanic current, having simultaneously to decompose two salts each offering a different resistance, must, according to its intensity, vary the composition, and therefore, also, the colour of the deposited alloy. Practice has demonstrated that a feeble current principally decomposes the copper salt, without affecting the zinc salt sensibly, and the result is a red deposit; whilst a great intensity in the current decomposes the solution of zinc too rapidly, and throws down a white or bluish white deposit. This is the case more especially with newly prepared baths, and it is quite common to see one side of the same piece (the one facing the anode) covered with a beautiful yellow, while the opposite surface has only received a reddish coat. If such is the case, it is an indication of irregularity in the conducting power of the bath, which, however, becomes more regular after being used for some time. The inconvenience of too red a deposit may be remedied by increasing the number of the elements of the battery, by employing stronger acids, or by decreasing the number and the surfaces of the objects to be plated. The other inconvenience of too white a deposit will disappear by diminishing the number of elements or by increasing the surfaces to be covered. The deposit may also be modified by substituting for the brass anode either a sheet of pure copper or one of zinc, or by simply hooking one of these sheets to the brass anode. A bath of pure copper will be transformed into one of brass by the use of a zinc anode, and an electro-bath of brass will become one of copper by the aid of a copper anode.

The disposition of the baths for brass plating varies considerably, but it is always necessary to have all the articles suspended at about equal distances from the anodes. For small articles which can be suspended, the bath may be subdivided by several anodes forming partitions, so that each loaded rod is between two anodes, or smaller separate baths employed. The anodes should, if possible, be removed when the bath is not at work.

Brassing Lead and Pewter.—Lead and pewter should be cleansed in a solution of about 4 ounces of nitric acid to the gallon of water, in which they remain for half an hour. Pewter is more easily coated with brass than lead, but the same bath may be used for either. They are then rinsed, scoured with sand, and rinsed again. A good battery power and a large surface of anode are necessary, especially at the beginning of the deposit. The proper temperature of the bath for brassing lead, pewter, and tin is about 90° F. Stirring articles in a brass bath has a tendency to cause the deposit of copper alone.

We have stated in a former article that tinning, like coppering and brassing, often completes the cleansing and preparing process of certain metals, such as cast-iron, previous to receiving more valuable deposits. Tinning by the wet process is effected by three different methods:—

1. *By Exchange*; that is, by the dissolution of a small quantity of the cast-iron to be immersed in a tin-liquor; the former replaces an equivalent quantity of the latter, which then covers the remainder of the immersed metal with an adherent and continuous coat. This process secures, however, but little solidity; it is more a colouring with tin, analogous to the films of gold and silver which are obtained by *immersion*, and of which we shall have to speak hereafter.

2. *By Electricity*, by the decomposition of certain tin solutions by the aid of the elements of a battery, separated from the liquors.

3. *By Substitution or Double Affinity*, which consists in immersing in the tin solution, at the same time, two different metals which are kept in contact like the zinc and the iron. The zinc, for instance, instead of covering itself with a coat of tin, as would have been the case in the method by *exchange*, will dissolve and take the place of the tin in the chemical compound forming the bath; and force the latter to deposit itself on the iron, which had been placed in the liquor also, in adherent, homogeneous, and continuous layers.

Tinning Bath by Exchange.—This first process, especially when applied to iron, is not of much importance, as the layer of tin formed is a mere film, and not capable of preserving the metal covered from oxydation. It is, however, useful as a preparatory process for metals which are to receive thicker deposits afterwards by means of one of the other two processes.

To prepare a bath for this purpose, dissolve by heat in 4½ gallons of soft water in an enamelled cast-iron kettle.

Ammoniacal alum, 11 ounces.
Fused protochloride of tin, ⅓ ounce.

The iron articles are cleansed and rinsed in fresh water, and immersed as soon as the solution boils. They are instantly covered with a film of tin of a fine dead white lustre, which is rendered bright by friction. The bath is maintained at the proper strength by small additions of fused protochloride of tin. This bath is also suitable for a preliminary tinning of zinc, but as in the case of iron, the coating does not offer sufficient resistance to oxydation. If the objects thus whitened or tinned present large surfaces, the scratch-brush is resorted to to produce brilliancy. In the tinning of zinc by simple immersion, the ammonical alum may be replaced by any other kind of alum or even by sulphate of alumina, but experience will soon teach that the same substitution cannot be made when treating iron, cast-iron, or steel.

If metals other than iron or zinc are to be tinned with the above solution, it is necessary to introduce the battery, but in that case it is preferable to use special liquors, which will be described in a future article.

(*To be continued.*)

A New American Invention.—Mr. Henry Lefort, of Newark, N.J., has patented a new and improved watch crown which can be easily held and adjusted in the pendant and is simple in construction. It consists in a spring bushing loosely mounted on a flanged sleeve adjustable on the pin of a watch crown, whereby the crown is held in the pendant by the pressure of the spring bushing against the sides of the pendant.

HALL MARKS AND TRADE MARKS.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—I have read an "Old Hand's" letter on the above subject with much interest, and as a watch manufacturer should be glad to give expression to my own opinions. I gather from it that your correspondent considers that the name and trade mark of the actual manufacturer of any article ought to be a sufficient guarantee of its quality, and that as a compulsory official stamp is not required to keep up the quality of cutlery, so silversmiths, and I presume jewellers and watchmakers, could in like manner dispense with one. Another of your correspondents, Mr. E. J. Watherston, argues that the connection with the Goldsmiths' Company is a very great hindrance to trade, and that we are quite unable to compete with the Americans in consequence.

Again, on the other hand, there are many manufacturers and dealers who desire a continuance of the present system, and say that the agitation and present uncertainty operates unfavourably on trade, as it prevents capital from being employed, on account of the possible depreciation which would take place in existing stocks if the duty were abolished. Furthermore, the hall mark is considered to be a protection to the British workman; it has the effect of localising trade, and it should be remembered that if the control of the Goldsmiths' Company were removed there would be no check upon trade marks being applied at foreign seats of manufacture, and it is a question if working silversmiths would derive the least advantage. The trouble and worry of manufacturing in this country is so great, that all who can, prefer to purchase ready-made goods, therefore dealers might flourish while the workmen starved.

This has already taken place in the watch trade, the almost general use of the keyless-going barrel watch has given full scope to the larger and cheaper producing powers of foreign manufacturers, and the unfair use of the London hall mark, combined with the co-operation of our own dealers, has enabled them to dispose of their products in our best markets. In many cases these watches bear the names of English retailers and are sold by them as being their own make. It has been argued that the way to prevent this is to abolish the hall mark altogther, but this is easier said than done, and if it were done, I do not believe that the trade would be improved, because the distinctive mark of a genuine English watch would then be extinct, and larger scope than ever would be given to foreign competition.

Names and trade marks fail to meet the case in the watch trade, as the actual manufacturers do not come before the notice of the British public. Formerly, retailers had their stocks of English watches made to order, and the relations between them and their manufacturers were of a much more intimate and friendly nature than at the present time.

It was then to the interests of the latter to keep entirely in the background and to abstain from all appearance of competition, but the International Exhibitions of the last twenty years have done much to alter this state of things, and most manufacturers of any standing are regarded with a certain amount of jealousy by retailers, who imagine (with very little cause) that their trade is being interfered with. As a manufacturer, I can testify that the public very seldom visit Clerkenwell; in these days of suburban (and in many cases, maritime) residences the hours given to the office are gradually being curtailed. The telephone and telegraph are called into requisition to economise the abbreviated time, and the retailer being on the spot is more certain than ever of continued patronage. Still, there are exceptions to this high-pressure system, and Clerkenwell is sufficiently near to the City and West End to enable any one to purchase a watch of a manufacturer if he likes to take the trouble. This fact is, I think, often lost sight of in referring to the customs prevailing in other countries, and is a great cause of the comparatively disjointed system on which Clerkenwell manufacturers have to work.

The hall mark is a convenient form of guarantee of origin, inasmuch as it reveals no secrets; the trade mark of some eminent retailer might perhaps satisfy the public, but it would then be necessary for him to undertake the responsibility of manufacturing, as watch cases cannot be marked after they have passed a certain stage of progress. No retailer would sell watches bearing the trade mark of a manufacturer unless, indeed, the very cheap ones, such as are made by machinery.

I have studied the subject much, and have come to the conclusion that Clerkenwell manufacturers are best off under existing circumstances, and that it would not be to our advantage to come directly before the notice of the public here.

The name of the seller, like charity, "covers a multitude of sins"; it does not always follow that a watch gives satisfaction, and a customer might take an objection to a certain make, whereas on the other hand the retailer generally repeats his orders to those who serve him well. A watch is not like a piece of plate or jewellery, but it requires constant supervision, which can only be conveniently given by those close at hand. I therefore think that hall marking will not be superseded by trade marks in the watch trade, and that the latter afford no more protection against forgery. While writing this letter, I have seen a statement that an eminent Sheffield house had their trade mark forged in Germany, that they had to defend their right in a German law court, and it took years of litigation and the expenditure of some hundreds of pounds to obtain a verdict in their favour. I think that the custom of hall marking foreign-made cases should be put an end to. The assay officers know that the system is practised, but they cannot legally refuse to mark work which is brought by registered dealers. The next best thing to stopping this practice is to thoroughly show it up, but the adage that "two of a trade never agree" is especially true of watchmakers, and the foreigner profits by our disunion. I wish to say in conclusion, that there are some retailers who carry on their business *sans peur et sans reproche*, and who do not stoop to avail themselves of the subterfuges I have been speaking of, also that some manufacturers have forfeited the confidence of their customers both at home and abroad by palming off Coventry work at the price of London, the said work being placed in cases bearing the London hall mark. Foreigners have had every encouragement given to them to compete with us in the art of deception, but, as I have already said, I do not think that we are likely to improve matters by abolishing our hall mark, which should be confined to its original design, viz., to denote the quality of the productions of English workmen.

I am, etc.,
James U. Poole.

33, Spencer-street, Clerkenwell,
June 18th, 1880.

Nearly three hundred thousand pounds worth of pearls were fished in the Persian Gulf last year. No less than thirty divers fell victims to the monsters of the sea during the same period.

Artificial Production of Diamonds.—Mr. Hannay, who succeeded in producing diamonds some time ago, has described the process in detail in a paper read before the Royal Society. The learned chemist stated that the discovery of making diamonds profitable in a commercial sense may be hit upon any day, or may take a hundred years, but he believes himself to be on the road to the discovery.

BRITISH HOROLOGICAL INSTITUTE.

SOME time ago, while speaking of a foreign horological school, we mentioned that there was every prospect of our possessing a similar school of our own in Clerkenwell before long, and we have now the pleasure of announcing that the scheme is in course of execution. Classes for instruction in escapement-making and finishing, under the able management of Mr. Curzon and Mr. Bickley respectively, were commenced on the 28th ult.; that these courses will prove of great advantage to the rising generation of watchmakers there can be no doubt. The selection of the provisional teachers made by the Council is very fortunate, as both gentlemen are masters in their special line, and thoroughly qualified to fulfil such responsible duties.

Mr. Henry Ganney read a very interesting paper on the "Practical Value of Horological Schools, and their work at the Paris Exhibition of 1878." The lecturer dwelt on the great benefits these institutions had conferred on the watch trade in France and Switzerland, facts which are undeniable. These institutions are in harmony with the rest of educational facilities; the grand scheme of our School Board has been in application for many years in that country, and the standard of education has gradually risen; so that a youth enters one of their technical schools much better equipped than we can expect our own to do for some years to come; and still the results obtained have been of very slow growth. We mention this simply to prevent disappointment, as there are many who look upon the establishment of an Horological School as the immediate salvation of the watch trade, while we feel certain that even if this laudable scheme is carried out with all the energy and perseverance possible, *practical* results will not be felt for a long time to come.

The Silver Medal of the Turners' Company is offered to the producer of the best set of gauges suitable for watchmakers. The successful competitor would be required to give an undertaking to supply the gauges at a price to be stated by him at the time of submitting his instruments for competition, and the medal will be withheld until the committee are satisfied that this condition would be fairly fulfilled.

The instruments required are—

1. A slide gauge, with vernier to register variations to within the $\frac{1}{500}$ of an inch on one scale, and subdivisions of a millimetre on another corresponding scale.

2. A gauge on the principle of the present *douzième* gauge; divided to the $\frac{1}{200}$ of an inch on one scale, and with divisions of a millimetre on another scale.

3. A series of three plates with tapered slits for measuring pivots and the like. The smallest measurement required is the $\frac{1}{500}$, and the largest $\frac{1}{12}$ of an inch.

In the event of the gauges of any competitor appearing to the committee to be satisfactory, the committee would adopt such gauges as the gauges of the Institute.

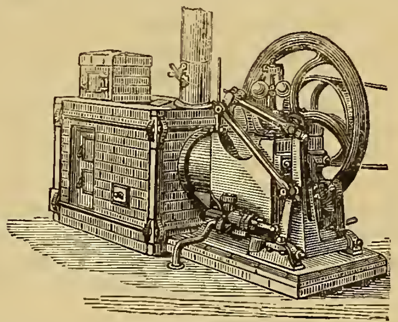
Competitors will understand that cheapness of production would be considered an important element, the desire of the committee being to place within reach of all members of the trade uniform reliable measuring instruments.

Instruments intended for competition are to be left at the Horological Institute, Northampton Square, not later than Saturday, October 2.

International Exhibition of Tools connected with the Watch and Jewellery Trades in Geneva.—This Exhibition, the programme of which was published in these columns in due time, is now in full swing, and said to be extremely interesting. The 97 exhibitors are classified as follows: 49 Genevese, 32 Swiss of other cantons, 5 German, 1 American, 1 English, 1 Austrian, 6 French, and 2 Italian.

AN ENGINE WITHOUT A BOILER.

MESSRS. W. H. BAILEY and CO., of the Albion Works, Salford Manchester, have recently introduced a power engine, which will prove a great benefit for small industries. It is just the engine required by those who have to consider space, safety, reliability, easy working, cheap maintenance, and last, but not least, price. All these points have evidently been carefully studied by the manufacturers, and disposed of in a most ingenious manner. Everybody knows that the atmosphere expands in proportion to the amount of heat applied, and on withdrawal of the heat it collapses to its original bulk. This well-known property of the atmosphere forms the basis of Bailey's Hot-Air Engine, hot air taking the place of steam. From the cut it will be seen that a small stove takes the place of the ordinary boiler, and all it takes to keep a one-horse hot-air engine at its full power is about 40 lbs. of coke per day; any other fuel or waste fuel can, however, be used. The absence of a boiler does away, of course, with explosions.



The manufacturers state that the engine causes no danger or nuisance whatever, as it consumes its own smoke, and prevents smell when oils are burnt; it works without the slightest noise or vibration, and for years without interruptions or repairs. These claims are borne out by numerous testimonials from employers of their engine, and we hear that over one thousand are in successful operation. We strongly recommend those of our readers who are about to introduce engine power, to send for one of Messrs. Bailey and Co.'s circulars.

Presentation to the King of Greece.—The King of Greece was entertained and presented with an address of welcome by the Corporation of London, at the Guildhall, on Wednesday the 16th ult. The King was also shown the design of a casket which is to contain the address. The execution of this piece of goldsmith's work is entrusted to Mr. Benson, the city jeweller to the Prince of Wales. It is in Greek style, an oblong octagon in form, supported, at the four corners, by City dragons, each grasping a shield of the civic arms. It stands upon a blue velvet cushion, with gold roses. The front of the casket will have a medallion portrait of the King of Greece, festooned with fruit and flowers, and bearing a laurel branch in further token of success. Above the portrait, the winged cap of Mercury, as the Greek emblem of commerce, is appropriately placed; and below the King's initial letter, enamelled in blue and white, forms a pendant. The Royal Orb of Greece commands exalted positions at each corner of the cover, around the extreme edge of which are tablets containing names of the celebrated Greek poets, philosophers, and orators. The Greek honeysuckle ornament on the box, and the Grecian key border around the base, suggest the art for which Greece was so renowned. The whole is surmounted by the Greek arms, with the national supporters, upholding the jewelled crown of the King of Greece.

FREE TRADE IN GOLD AND SILVER PLATE.

Among the many reforms calling urgently for the attention of the present Administration must be included the abolition of the duties on gold and silver plate, and a revision of the laws relating to compulsory hall-marking. Mr. E. J. Watherston, who has made this subject his special study, speaks with the authority of a manufacturer and a political economist. He has shown, in a series of letters addressed to a London contemporary, that the subject has side issues of the greatest importance, which the theoretical politician may be excused for overlooking. Foremost among these issues is the effect which the taxation of silver plate has upon the demand for the raw material as used for manufacturing purposes, and which adds to the difficulties of Indian finance. In addition to this, the high price of silver plate, rendered necessary by the imposition of a vexatious duty, places a premium upon the disposal of its inferior rival—electro-plate. Lord Hartington's early attention should be given to this subject. It is manifest that, in the present complicated state of Indian finance, which is so seriously affected by a rise or fall in the price of silver, hindrances of every kind which tend to limit the absorption of the raw material should be swept away. For this reason alone, if for no other, the tax on gold and silver plate, which is a relic of a discredited system, should be abolished with as little delay as possible.

As a matter of fact, the manufacture of silver plate in this country is interfered with and harassed in every conceivable way. Not only is a duty levied of 1s. 6d. an ounce, which, at the present price of silver, amounts to 35 per cent. of the cost of the raw material, but the manufacturer suffers from old, mischievous, and ridiculous laws, whose only claim to respect is their antiquity. Hall-marking, we know, in the minds of many people, is regarded as a proper protection to the public, as being a supposed guarantee of the quality of the silver, and as distinguishing it from its competitor, electro-plate. But such a guarantee, except with reference to watch cases and a few other articles, does not exist, and is not sought in the case of gold, which is eighteen times as valuable as silver. As, therefore, a voluntary system is found to work well in the case of the more precious metal, no good reason can be shown for maintaining a compulsory system in the case of silver. Its impolicy is second only to its injustice. The practical effect of compulsory hall-marking is to prohibit the sale, in this country, of foreign-manufactured silver plate; manufacturers, being protected from foreign competition, have no incentive to enterprise. As a fact, therefore, no attempt is made to improve the quality of their wares, and a glance at a silversmith's window amply proves that art in this particular trade has made no progress, modern silver plate being simply hideous. On the other hand, modern jewellery, of the better class, has made rapid advances of late, and International Exhibitions have proved that the English goldsmith, with no other guarantee of quality beyond his "good name," can hold his own against all comers.

It is idle to expect, in these days, that a mark, signifying only the quality of a material (and that not certainly) will cover sins of design and execution. It will do no such thing. Public taste is rapidly improving. The eye is accustomed to great excellence of design in the case of glass, porcelain, and furniture, not to speak of house decoration, brass, and jewellery, and is, therefore, not likely to be imposed upon by a fraud simply because it bears the hall mark. With one exception, all trades have improved; the exception is that of the silversmith, and he will not have to look far for the cause of his failure. It is to be found in the hindrances to improvement by which he is surrounded. We can only hope that the agitation for repeal of these duties now healthily proceeding will lead to complete "freedom of trade" in this industry, at least. Trade marks will, in reality, be a far greater protection to the public than a hall mark. To forge the former is attended by penalties easily recoverable at common law; the forgery of a hall mark, as has been lately proved in London, is an every-day occurrence. A few weeks ago, some 650 pieces were seized by the Goldsmiths' Company, of London, and fines were levied amounting in the aggregate to nearly £6,500. But the company was powerless to collect the fines, and so the forgers laughed at the penalty. Hence hall marking is not only no protection whatever to the public, but, on the contrary, an utter and stupid delusion.

The best course to be taken by any Government, but more especially by such a one as the present, is to sweep away all the laws which now misgovern the trade, and to leave manufacturers to mark their own wares in such a manner as they may find to be satisfactory to their customers—the public. That they will soon find out such a method may readily be assumed. Broadwood, Collard, Erard, and other well-known manufacturers, require no "hall mark" for their pianofortes. Neither should a silversmith for his wares. Complete freedom of trade is as advisable in the one case as in the others, and a reform in this direction would not only create a "new departure" in a most important and artistic branch of trade, but it would give hope to the disciples of Richard Cobden, that the great principles of which he was the exponent and the apostle have not lost their hold upon the minds and hearts of statesmen.—*Financial Reformer.*

The "Daily News" on the Silver Trade.—The present ought to be a very favourable time for silversmiths. Their raw material is remarkably cheap. The impost of which they complain is no doubt a real grievance, and its removal would stimulate trade. But in spite of it, and of commercial depression, there has not often been more money spent in England on articles of luxury, and in especial there never has been a time in which so large a number of persons of comparatively moderate means have been willing to spend money on the decoration and embellishment of their houses and furniture. Nor is there any lack of artists and antiquaries to design. It is difficult to believe that if silver plate of really attractive design and moderate price were produced it would not rapidly become fashionable. The first cost can of course never be very low. But if a judicious householder were to sit down and calculate the amount of money spent on fragile vessels in the twenty, or still better, thirty years' housekeeping, he would begin to look at the cost of plate in a different spirit. How much, let the persuasive silversmith ask of the housewives of England, do a dozen of tumblers cost; how long do they last, and what is the precise value of the fragments to which the housemaid sooner or later (generally sooner) reduces them? To this purely arithmetical consideration the decorative effect of what our ancestors used to call a good cupboard of plate has to be added. Fault has been not unfrequently found, and perhaps not unjustly, with the modern habit of piling shelves and buffets with crockery which is never intended to be used. Sometimes, indeed, it is used, and happy is that housemistress who has no occasion to earn the well-known compliment for being mistress of herself. Plate in the same position is both ornamental when not used, and useful without danger. The only valid objection ever made to its use is that it is a temptation to burglars; but this is a bad compliment to Sir Edmund Henderson. There are perhaps few things of the kind in which money can (putting the burglars out of the question) be spent with greater prospect of enduring satisfaction than plate of good design and workmanship. It is not, like china and like pictures, liable to depreciation as an investment by changes of fashion, and easy destruction by accident or neglect. Even the test of fire will leave something of its value if not of its beauty to console the sufferer. In the best days of art many of the great masters took particular pleasure in designing and fashioning such work, in which the material seems to be especially worthy of the thought and art employed. The old silver cup, the candlesticks (it is practically impossible to play whist properly without silver candlesticks), the tea-caddy, the tankard for liquors cooling or comforting, the saltcellars emblematical of hospitality, have of late years ceased to rank as they once did among the heirlooms of any family with pretensions to continuity of history. With a little trouble, and by going the right way to work, there is no reason why they should not once more take the same place.

The Value of Hall-marks.—The *Daily Telegraph*, in a leader devoted to forged hall-marks and sham antique plate, says:—"Looking at the comparative facility with which such marks can be impressed in the plate, it is becoming extremely questionable whether there is any practical use in the retention of hall-marks at all; whether beauty of design and goodness of workmanship would not be the best criterion to follow; and whether free trade in the manufacture of plate would not be, on the whole, preferable to a monopoly that fails to protect the public from fraud. The vigilance of the Goldsmiths' Company may enable them, now and again, to pounce upon a particular offender; but, in the meanwhile, a host of adulterators, as crafty and as unscrupulous, may escape, unwhipped of justice."

FIRE-GILT ALBERTS AND BRACELETS.

We beg to call the attention of those of our readers, who keep imitation jewellery among their stock, to a beautiful class of goods lately submitted to us for inspection. They consist principally in ladies' and gentlemen's alberts and bracelets. Of most attractive design, colour, and finish, they are certainly superior to anything we have hitherto seen in this line. Dealers are well aware that most imitation goods gilt or electro-plated, lose their bright colour after very little wear, owing to the inferior metal, generally brass, which forms the basis of this class of jewellery, and to the little resistance their surfaces offer to acids.

The goods under notice are, however, entirely free from these defects, being of German silver, fire gilt, and capable of withstanding acids, thus securing a permanency to the brilliant colour. We may also state that the newest designs, many of very excellent taste, have been applied to these chains and bracelets, designs which have hitherto only been obtainable in high-class solid gold goods. The London agent for the manufacturer is Mr. A. Simmonds, of 7, Watling Street, E.C.

Coral.—The *Times* says that an extensive coral bank has been lately discovered about ten miles south from Sciarra, on the Neapolitan coast. Judging from the quantity and quality of the material already fished up, this new bank seems to be richer and more important than the one discovered about five years ago not far from the same spot. The new Italian fisheries law secures to the discoverer of a coral bank for two years the exclusive right of fishing upon it. But this enactment has not yet come into operation, and several fishing vessels from Torre del Greco have already flocked to the scene in the hope of making a rich harvest. A similar fate has happened to the coral bank discovered last April in the waters of Porto-Ferrajo.

OUR TOOLS.

Every labour-saving machine deserves attention in these days, as economy of time means reduced cost of production—the most effective weapon in the war against an ever-growing competition. We have now before us an extremely neat and handy tool, which will find ready acceptance in every workshop. It is called Hall's Patent Double Compound Lever Cutting Nippers, manufactured by the Interchangeable Tool Company, of New York. The cutting pliers hitherto obtainable all lack power, necessitating the entire strength of both hands in cutting wire, and under some circumstances the operation becomes difficult. This new nipper (see cut in advertisement in another part of this Journal), possesses great power, and wire cutting becomes an easy and rapid process. In addition, it is interchangeable, and the fracture of jaw or handle does not render the tool useless, as the broken part can easily be replaced at a trifling outlay. It is made entirely of the very finest quality of steel, made expressly for this company, the different parts being drop-forged by Colt's Fire-Arms Company, of Hartford, Conn., U.S.A.

This tool will be obtainable from any of the leading watch and clock tool dealers in the United Kingdom. The sole wholesale agent for this country is Mr. F. Lazarus, 8, St. Pancras Station, Euston Road, London, to whom communications from *wholesale houses* should be addressed.

GOLD IN SOUTH AFRICA.

The *Natal Mercury* says:—"Rumours are afloat regarding the discovery of gold in Zululand. It is quite true that a fine little nugget, weighing one ounce, has been brought in from the northern side of the Tugela, but it is quite premature as yet to say that a goldfield has been discovered." As for the Transvaal, our own correspondent at Pretoria writes under date Feb. 21st:—"There are rumours of all kinds abroad as to large discoveries of gold being made, but these must be taken at a large discount. The fact appears to be established, however, that the old diggings at Spitzkop, etc., are 'looking up' again, for in one week 45 ounces of gold were taken out of the claim of Messrs. White and King, and 51 ounces in the following week. It is said that a far larger quantity has since been taken out of the same spot. There is undoubtedly payable gold in the Lydenburg district, but there is nothing yet that will warrant people at a distance 'rushing' into the toilsome and uncertain life of gold digging."

Trustworthy Watch-repairers.—A watch-cleaner, named George Fox, who has carried on business for some time in a lock-up shop at Mexborough, has absconded with a large number of watches which had been entrusted to his care. It was found that he had gone to Sheffield on Wednesday, and one of the constabulary authorities has written to one of the Mexborough tradesmen informing him that his gold watch had been offered in pledge. As soon as intelligence of the disappearance of Fox was made known, his shop was broken open by the police, but none of the missing watches were discovered. One sufferer was doubly unfortunate, for he had not only lost his watch, but had paid 5s. beforehand for its repair. The thief is still at large, the party sent for from Mexborough having taken a charitable view of the case and got the man set at liberty. A watchmaker, named Goodyear, of Wombwell, near Barnsley, is said to have acted in a similar way, the pawn-tickets of the watches having been found in his house.—*Pawnbroker's Gazette.*

HINTS TO REPAIRERS.

(*Continued from page* 157.)

It is necessary for the rack-arm to be made so that it will ride on the snail easily, if the striking part, from any cause, should be stopped and the other part going, because if it did not ride, the clock would stop altogether between the hours of 12 and 1. Therefore we recommend a guard pin, as already stated, because in our business it is necessary for our fair fame to guard against every possible contingency. The teeth of the rack may require dressing up in some cases, and to allow this to be done the rack may be stretched a little at the stem, with a smooth-faced hammer on a smooth anvil; or if it wants much stretching, take the pin of the hammer and strike on the back, with the front lying on the smooth anvil. The point of the rack catch will be much worn, and when dressing it up it will be safe to keep to the original shape or angle. The point of the rack catch is always broader than the rack, and the mark worn in it will be about the middle of the thickness; so enough will be left to show what the original shape or angle was.

The collet in front of the hands is a little thing, but it is seldom that we see one right; one that will hold the hands firm, and allow them to be moved small portions of space with ease and certainty.

Before making a collet, first straighten the minute spring, and put it on its place on the centre pinion, and put the minute wheel on its place on the top of it, and then the minute hand on its place; you will now see the space there is from the surface of the hand to the pin hole in the centre pinion. Make the collet so high that it will just cover the hole, and then cut a slit in the collet just as deep as the hole is wide; make the slit to correspond with the hole in every way, and in such a manner that when the pin is put in it will fit without shake. A collet made in this manner will last as long as the clock, and when the minute spring is set up the hands will always be firm, and at the same time more easily, and not affect the motion of the clock when they are set backward or forward. The square on the pipe of the minute wheel sometimes projects through the minute hand, and the collet presses on it in place of the hand. When this is the case it should be filed down, because the minute hand can never be held firm unless the collet be very much hollowed at the back, which it is not advisable to do.

The suspension of the pendulum, the pendulum spring, and the action of the crutch or back fork on the pendulum, are all of the most vital importance. The spring should be perfectly straight, and should fit into the slit of the cock without shake, and the slit should be perfectly straight and at right angles to the front of the dial, or frames of the clock.

The back fork should fit easily and without shake, and the acting part stand at right angles to the frames. The pendulum bob should swing exactly in a plane with the frames and the dial, and after a clock has been put in its case, before putting on the head, it is well to get up high enough and look down to see that all these parts work as has been described.

In restoring the dials and brass work in the cases of these clocks, we do not advise those inexperienced in the processes to attempt doing the work, but get the bright work especially done by a brassfounder, or in particular cases the brass may be gilt. Those who are not afraid of spoiling their clothes, or making their hands yellow, may dip the brass pieces in nitric acid, and rinse in clean water, after the old lacquer has been taken off by first boiling them in potash. The nitric acid will clean and bring the brass to its original colour, and which must be lacquered afterwards.

(*To be continued.*)

TESTING COIN AT THE ROYAL MINT.

The Telephone as a Coin-Tester at the Royal Mint.

A very interesting report has lately beeen issued by the Deputy Master of the Royal Mint. This report tells us that over thirty millions of coins were struck at the Mint last year, and their value came to £648,289. Of these only £30,613 10s. is the recorded value of the gold coin struck, whereas silver worth more than half a million, and bronze worth £43,550 3s. 7½d., were minted.

It appears that Mr. Roberts, the chemist of the department, and his assistants, in conjunction with Mr. Lockyer, have last year being trying to adopt the processes of spectrum analysis so as to determine the relation existing between the density of alloys and their composition. They have also been endeavouring to utilise electricity and the telephone in order to test spurious coin, and what they have done in this direction is so ingenious that it calls for special remark. Mr. Roberts apparently starts from a discovery recently made by Professor Hughes, the gist of which is that equal and similar volumes of various metals and alloys have each a different effect on an electric current flowing round a coil of wire. As might be inferred, if two equally strong rapidly intermittent currents are flowing in two coils connected by a wire, their balance may be upset by putting a bit of metal in one of the coils, and a telephone can easily be made to indicate the disturbance thus created by the intruder. But if an exact duplicate of the piece of metal be put into the other coil the balance of the currents will be restored, and the tell-tale telephone silenced. The practical application of this pretty experiment in connection with coin-testing is plain and simple. Let the bit of metal put within one of the coils be a genuine sovereign, kept always at hand for testing purposes. Its presence will be made manifest by the noise of the telephone, due to disturbance of the balance of the currents in the coils. If the suspected coin is then put within the other coil of the apparatus one of two things will occur. The telephone will either cease to speak—in which case it is certain that the suspected coin is so exact a duplicate of the test coin that it has neutralised the disturbance in the balanced currents which the test coin caused—or the telephone will keep on sounding, in which case the suspected coin cannot be in composition the same as the test coin, and is therefore incapable of balancing it as a disturber of the induction currents. How far the apparatus can be made effective for popular use remains to be seen; but there can be little doubt that the experimentalists who have perfected it thus far are on the right track.

THE GOLDSMITHS' AND SILVERSMITHS' FREE TRADE ASSOCIATION.

The movement for freedom in the precious metal trades, hitherto principally carried on by individual effort, has now taken a more organised shape, and an Association has been formed with the following objects:—

1. To abolish the taxation of gold and silver plate.
2. To abolish the licences to deal in gold and silver plate.
3. To repeal all the laws relating to compulsory hall-marking.
4. To establish a system of voluntary hall-marking under the Trade Marks' Act.
5. To obtain a drawback of duty on existing stocks.

A pamphlet has just been published by the Association which we recommend to the careful perusal of everyone interested in these trades. It consists of a series of letters reprinted from the *Sheffield and Rotherham Independent*, and dealing with the above questions in a most able and thorough manner.

The Hon. Sec. of the Association is Mr. E. J. Watherston, of 12, Pall-Mall-East.

THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.*

By M. Grossmann, Watch Manufacturer,
Glashuette (Saxony).

(*Continued from page* 150.)

32. In the other method, the ratchet is screwed with three screws, on to the shoulder formed at the part of the arbor just above the barrel.

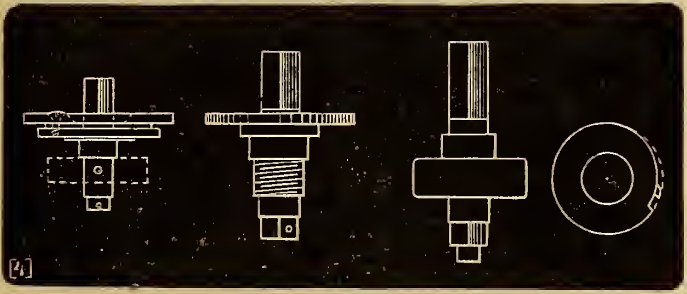


Fig. 4.

This system is still worse from the point of durability. There are only two small annular surfaces which constitute the hold of the barrel. The shoulder of the arbor, as well as the edge of the ratchet, wear away gradually the upper and lower side of the bridge, and the screws slacken their hold by the numerous little jerks of the click when winding the watch. Besides, the ratchet is subject to defects in hardening, and its hold is weakened by the three holes and sinks for the screws which must be rather close to the edge. In both these cases the core of the barrel arbor is a separate piece, screwed upon the arbor, or adjusted on it, and held in its place by a pin through both parts. The finger of the stop-work is secured to the end of the arbor by a pin through this latter.

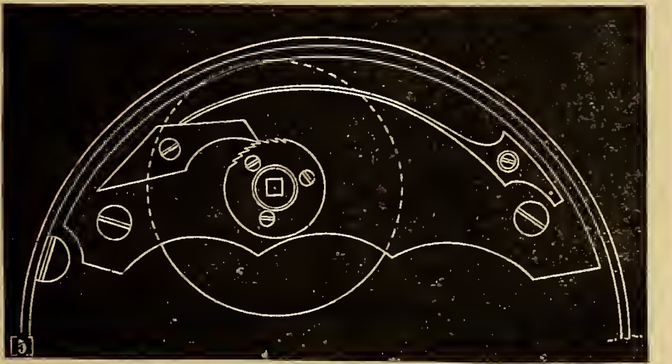


Fig. 5.

33. The most advantageous way, both for manufacturing and repairing, as well as for durability and good service, is to make the barrel arbor with two pivots, supported each by a bearing. An arbor of this kind is very easy to construct. The ratchet must be fitted on the square of the arbor, which is easier to achieve than the adjustment of the core of the Swiss arbors. There is no necessity for perforating the lower end of the arbor in order to secure the stop-finger in its place, which is attained by the lower bridge of the barrel. A barrel of this nature is much easier to take to pieces and to put together than a Swiss one. It requires merely taking off the cover of the barrel, and all is done; while with the other one the pin of the stop-finger must be taken off, and after opening the barrel, the pin joining the core to the arbor must be drawn out or the core screwed off before the parts can be cleaned, or a new spring put in, and afterwards all these arrangements have to be got together again.

34. In a frame, the pillar plate of which was hollowed out only 0·2 or 0·3 m. at the dial side, this space would suffice for containing a thin steel bridge for maintaining the lower pivot of the arbor. The same space would be necessitated for receiving in a solid way the pin for the stop-finger, if we do not wish to create that unfortunate state of many flat watches, in which it is hardly possible to draw out and put in that pin without splitting the end of the arbor. Thus it will be seen that there is not even an economy of space to be obtained by this system.

CHAPTER III.

The Click-Work.

35. The click is a necessary adjunct of the barrel and main-spring; its purpose being to prevent the retrograde motion of the arbor when the the winding action ceases. This function being rather out of connection with all the other parts of the movement, it cannot be a matter of surprise to see the click-work executed in a great variety of different ways, all attaining the same purpose with more or less ease in the execution, and with different degrees of elegance in appearance.

36. If simplicity and easy execution are required—especially if the click-work is to be sunk into the upper plate—it seems that the round adjustments deserve the preference. The most simple click-work of that kind would consist of the ratchet, click, and click-spring; the latter of circular form, and surrounding the ratchet with only the necessary space for free movement—both parts to be adjusted in a sink in the upper plate.

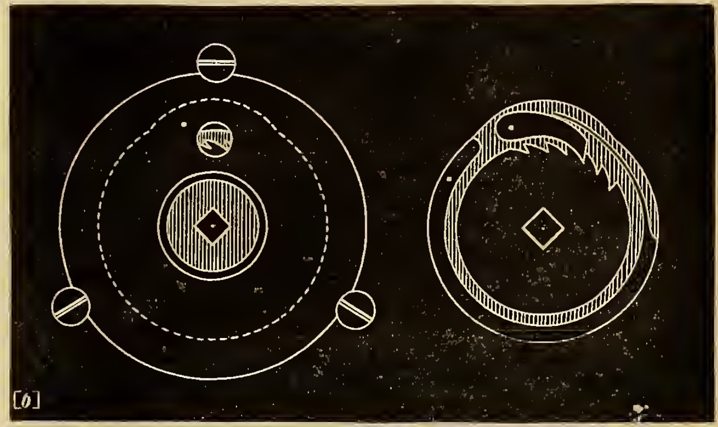


Fig. 6.—Click-work Sunk into the Upper Plate, and Covered by a Cap.

The click ought to move on a stud left in the sink or between two pivots. The whole arrangement would be covered and held in its place by a cap screwed on the plate, and perhaps sunk into it a trifle, just in order to centre it easier. A small hole through the cap, at a proper place, would be useful for lifting the click out of action when it is required to let the spring down. It would hardly be possible to have a simpler and cheaper and still quite reliable click-work than this one.

37. In watches, in the execution of which a greater degree of elegance is desired, the click and click-spring may be exposed by leaving a small annular space round the sink that contains the ratchet, on which space the cap is screwed. The spring is lodged into a circular sink outside this space, so that it is only covered a very little by the cap in order to be secured to its place. The thinner acting part of the spring may easily be formed in an eccentric chuck in the lathe. The click of this click-work is held by a stop screw, the head of which is countersunk into the lower side of the plate (fig. 7).

(*To be continued.*)

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TECHNICAL EDUCATION.

APPRENTICESHIP: SCIENTIFIC AND UNSCIENTIFIC.

By Silvanus Phillips Thompson, D.Sc., B.A.,

(*Continued from page* 160.)

Unfortunately, there are two difficulties ahead, which we cannot afford to blink. In the first place, we have no great technical schools or colleges such as France, Switzerland, and Germany possess for the higher technical training; hence we do not get scientifically trained men as employers, or as foremen and managers, or as teachers of technical classes and schools. Without these it is simply hopeless to begin with the apprentice. You cannot have the lower technical or industrial training without having the higher. And if you had the higher you would still want the lower. I am sometimes told in my advocacy of this scientific apprenticeship and of apprenticeship schools that the experience of France and Germany is against me, for there they educate, not the apprentice, but the master and the foreman. It is true that they do so, that the technical education they give is chiefly what I have termed the higher. France has had her great *Arts et Métiers* and her *Ecole Centrale* for nigh three-quarters of a century, and the magnificent institutions of Germany are, some of them, not much more recent. But France and Germany are alike finding out that they need the lower technical education also; and so we have on the one hand the *Ecoles d'Apprentis*, and on the other the *Fortbildungs-Schulen*. A single instance will illustrate this reaction. There is at Chemnitz, in Saxony, a "High Weaving School," one of the best of its kind, having fifty-four looms, twelve of them worked by steam power. This school was established in 1867. Since that date the manufacturers of chemistry have found it advisable to open an evening school of the type of a *Fortbildungs-Schulen* to instruct their apprentices in the theoretical parts of the weaving which they learn in the factories. I am confidently expecting to hear of a similar movement following the growth of weaving schools in Leeds, Huddersfield, Glasgow, and Bradford, for these weaving schools act the part of technical colleges for the particular industry, and do train the competent foremen and teachers, without whom the lower training of the apprentice cannot exist. I hold then that a necessary antecedent to the growth of a rational and scientific apprenticeship will be the establishment of technical high schools and colleges to train the men who will hereafter have the work of training the apprentices.

The other difficulty ahead is one which has greater elements of uncertainty in it—it is the divided attitude of the Trades' Union leaders towards technical education. While the best men amongst them recognise fully the value — the intrinsic value both to the industry at large and to the workers in particular—of thorough training, and are prepared to welcome cordially the technical education movement, and the elevation of labour by science, provided all reasonable securities be given that the just rights of those that represent labour be not trampled upon or impaired, there are others, unfortunately, who think otherwise, and who, seeing as it were, through but one pair of spectacles, cannot bring themselves to understand that a really skilled workman is much more likely to obtain constant employment and high remuneration, and to hold a more independent position towards the mere capitalists, than his unskilled and ignorant fellow-worker. It is too good to be true.

We may congratulate ourselves that there are men who, like Mr. Howell and Mr. Applegarth, know what technical training means, and who recognise its value. Let us hope that wise counsels will induce the thoughtful amongst the Trades' Union leaders in England to follow their brethren of France in helping forward all movements for the elevation of the skilled workman of the future. There is one other matter in connection with this that I must just advert to. If it were at all probable that many apprenticeship schools were to be suddenly instituted in all the skilled industries, so that in three years time the skilled industries would be flooded with an extraordinary proportion of apprentice labour, then I think the Trades' Unions would have some right to complain, and would be justified—from their point of view—in resisting such a result. But this is the last thing that is likely to occur. Apprenticeship schools cannot suddenly swamp the labour market, for the simple reason that we have not yet the higher technical training to provide teachers for such schools; and when we have these, it will take years to develop even a single school. The process of replacing workshop drudges by trained apprentices will be a very gradual one, and will be more likely indeed to make apprentice labour scarce than plentiful during the transition period.

There remain now only two practical points to which I must allude before drawing to a close. Careful observation convinces me that there are three essentials to the success of good apprenticeship teaching. Those essentials are good teachers, a sound system of instruction based in the handicraft trades upon drawing rather than upon written language or mathematics, and a real scientific training in the use of tools. Of the capital importance of drawing as a means of education, and of the prominence given to it in the most successful of all the apprenticeship schools, I have said so much elsewhere that I will not dwell upon the matter at greater length.

Of the value of a real scientific training in the use of tools, we can hardly make too high an estimate. In every trade tools are used, and the essential principles of the use of them are common to all, though the forms of the tools vary. Now, if there is one thing an apprenticeship school can do, it is to teach a boy the scientific way of making and using a tool. For example, in the La Villette school the boys make almost all their own tools, except files; on the one hand they forge their own hammer heads, and on the other construct machine tools, lathes, planing, slotting and shaping machines, and the like. But no boy must make a tool without knowing why it is to be made of the particular form chosen. He must sharpen his tools to particular angles, because particular angles are shown by scientific experiment to be best for certain work, giving the greatest effective result with least expenditure of labour. The course of technology in that school is a course almost entirely devoted to tools and machinery connected with tools. Amid the exigencies of trade in an ordinary workshop there is no time to study all this. Yet nothing can possibly be of greater importance to the workman. We see what attention is given to this matter in the United States, what striving there is to perfect tools and to invent new ones, and, depend upon it, all this is of vast significance for the future. Every advance in the use of tools means not merely an advance in producing power, but an advance in civilisation. You can read the history of the growth of human civilisation in the history of tools, from the flint implement down to the last new complicated labour-saving appliances. How comes it, then, that we have hitherto paid so little attention to this matter? Why have we not a science of tools, a science of organology (ὄργανον, a tool), if you will permit me to invent the term? Surely, in any future schemes for founding technical colleges, we shall find some place for this neglected branch of science.

(*To be continued.*)

THE WATCHMAKER JEWELLER AND SILVERSMITH'S TRADE JOURNAL.

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

Entered at Stationers' Hall.—Registered for Transmission Abroad.

CONTENTS.

	PAGE
The Time Work and Time Signals of the Greenwich Royal Observatory	11
Practical Instructions to Jewellers, Silversmiths and Electro-platers	13
Silver Trade	14
The Goldsmiths' and Silversmiths' Free Trade Association	15
Registration of Trade Marks and Designs in Italy	15
A Few Words on Gems and Precious Stones	16
Technical Education	17
Hints to Repairers	18
Caution	18
The Construction of a Simple but Mechanically Perfect Watch	19
The Art of the Silversmith	20
"Flashing" in Assays of Gold, and on the Influence of the Metals of the Platinum Group on it	21
Patents	i
Monthly Record of Bankruptcies	ii
Directory	iv
Advertisements	i—xii

No. 63.—Vol. VI.] AUGUST 5, 1880. [Subscription, 5s. per Annum. Post Free.

THE TIME WORK AND TIME SIGNALS OF THE GREENWICH ROYAL OBSERVATORY.

By C. Stuart Murray.

(*Continued from page* 2.)

THE time of a degree of longitude is four minutes, and the distance at the equator has been computed at nearly seventy English miles. Each degree is divided into sixty minutes, and each minute into sixty seconds—not minutes and seconds of time, but of space. In no two circles of latitude is the longitude alike between any particular meridians, because as they all centre at the poles it follows that the distance or angles lessen as each circle of latitude is passed. As every equatorial degree means four minutes in time, it follows that as fifteen times four minutes are sixty, then sixty degrees make one hour. Calculations have to be made for the different latitudes in which meridional points lie, by which means exactitude is arrived at. How the great circles came to be divided into 360 the writer has never seen clearly set forth; but it has been ascribed to the ancient Egyptians, as agreeing with some standard measure of their own, and from them it passed westwards to Europe. We found it so, and as the Greeks used it it was ready made to the hands of modern nations. We have not gone into an explanation of the great circle of the equator nor the secondary circles of the terrestrial sphere, because they belong more properly to the domain of astronomy than to our present subject.

It may perhaps be some information to mention that proposals have been made now and then for a standard time for the whole of the earth; that is, that there should be no a.m. nor p.m., but noon at Greenwich, and then run on to 24 o'clock all round the world, whatever condition the day might be in. This would be astronomical time with a vengeance, and having so far given the threads of our argument to the reader we will at once travel on in our time-making path.

The twenty-four time scheme would be good for watchmakers, because a vast number of people who could afford it would have watches made with double sets of hands, one set for local and the other set for mean time. The Americans, with the true instinct of their "go-ahead" character, have always worked their ocean sailings from Greenwich as a first meridian, by which they have been able to use that invaluable seaman's guide, the *Nautical Almanac*, and that saves them an immense amount of troublesome computation which they would have to go through if they took their first meridian from any of the observatories on the Atlantic seaboard. There is no publication of its kind in the world to touch that splendid ephemerides; there never was, and it seems beyond the scope of human calculation that there ever will or can be.

In speaking just now of the lessening of meridional degrees from the equator to the pole, we said that calculations had to be made for the variations of these degrees on each side of the Greenwich or standard meridian. This is done in the *Nautical Almanac* three years before they are wanted; and we feel sure that all persons connected practically or otherwise with ocean navigation will agree with us that if the highly trained scientific staff of the Royal Observatory had nothing else but this almanac to show for the very moderate sum which that staff annually costs us they would have deserved well of all English-speaking nations.

The *Nautical Almanac* is the outcome of Dr. Nevil Maskelyne, a former Astronomer-Royal. He had been a clergyman, but becoming an assistant to Mr. Beasley, the third Astronomer-Royal, he abandoned the pulpit and took to the stars. In 1761 he went to Saint Helena to observe the transit of Venus, and to find out if possible what is called the parallax of the "fixed stars." It would occupy too much space here to give an explanation of the meaning of this term "parallax." It must be sufficient to state that it is formal of two Greek works signifying "changing beside"; or the difference between the true and apparent place of a heavenly body as viewed from the earth. And here is perhaps something interesting to watchmakers. Dr. Maskelyne was appointed arbitrator on the Government side, with respect to the chronometers that had been sent in to compete for the magnificent prize of £20,000 that was offered by the Board of Longitude for the finest time-keeping instrument. He went to Barbadoes with one of Harrison's chronometers, which was then the subject of much public interest.

The *Nautical Almanac* was first published in 1767, and was the successor of the learned doctor's *British Mariner's Guide.* The almanac is always used at sea with the chronometer, and has tables of every phase and motion of the sun; moon, and stars, to enable the navigator to make his time, or rather to ascertain his time and position. Sir John Herschel, in his *Outlines of Astronomy* proposed one standard of time all round the globe upon the twenty-four hours basis. It is very doubtful, however, whether or not it could be carried out in practice.

Into the making or keeping of time upon a universal plan comes the puzzling problem to non-scientific minds, namely, the 180th degree of longtitude. If two ships having sailed, one by the eastern and one by the western route, meet at that point, they must respectively take up and let fall half a day, or they will be out of their late-reckoning. Supposing each ship to continue on her course without turning, and they meet again in London, the log of one will show a day too much, whilst that of the other will show a day too little! With one of them the day of arrival will be entered as Monday when it ought to mark Tuesday; whilst with the other it will be Tuesday when it ought to show Monday. To say that two ships shall leave the port of London on the same day, pass each other at the 180th degree of longtitude, one from the east, the other from the west, arriving in London again on the same day and that one shall be a complete day in advance of London time, and the other a complete day behind that time has feverishly exercised the brains of thousands. But so it is, and the cause is simple enough.

Days and nights are to denote certain periods of time, and are produced by the twenty-four hours turning of the earth on its axis. In daylight the earth faces the sun, and in darkness it is in its own shadow. The more turns, therefore, that are made, the more days and nights we have. By remaining on one portion of the earth those turnings carry us round with diurnal regularity, always placing us under the same meridian on each successive day. With a ship at sea, however, the case is different. She is in motion, and if she is going in a westerly direction, as the earth revolves from west to east, the ship is sailing *against* that revolving, and consequently making longer time than if standing still. On the other hand, if the ship is sailing eastward, she is going in the direction of the revolution of the earth, and her days will be shorter than when not in motion. As she is going *with* the revolution she is getting through her day more rapidly by the difference of the distance gone over, whereas when she goes *against* the revolution she is a longer time in reaching what we may call the shadow line, or night of the earth. Let us try and give a homely illustration of all this.

A ball is fixed on an axis and set in motion to represent the earth, turning, let us say, from west to east. Under the meridian we will place three ants; one of them shall remain perfectly still, the second shall travel in the direction of the turning of the ball, and the third, suppose at the same speed, in a contrary direction, or against that turning. Around the ball, marking a northern and southern hemisphere exactly, shall be a fixed ring which we will call the equator, or day and night divider. We have now our globe and travellers in motion, and if we watch what is going on we shall see that the ant that is moving the way that the globe turns will reach the ring sooner than the one that is moving in an opposite direction. The same course will also carry it to the daylight side quicker in the same way. From these movements it will be understood that one ant is passing from the Greenwich meridian with greater speed, and the other at a slower rate than the ant that remains stationary upon its own part of the ball. When the two travellers meet upon the opposite side of the meridional circle to that from which they started, it will be quite plain that the one that went the way of the turning of the ball will have shortened his days and nights to such an extent as to have gained twelve hours on that meridian, and the contrary one will have lost them by his days and nights having been so much the longer. The consequence of this contrariety of courses of the two ants will be that when they have both gone completely round the ball and met the ant under the meridian where they left it, the easterly one will be a day before, and the westerly one a day behind the non-travelled one. As a ship meets the sun in sailing eastwards she shortens her day in a proportion equal to the distance she has gone with the earth's rotation; and when, on the contrary, she sails westward, she lengthens her day by going with the sun, thereby prolonging the time of sunset by the distance she has gone in that direction.

This time will amount at the 180th degree of longtitude in an easterly direction to twelve hours gain, and in a westerly direction to twelve hours loss. In *Ross's Voyage to the Southern Seas* we read the following. "Having by sailing to the eastward gained twelve hours, it became necessary, on crossing the 180th degree and entering upon a west longtitude, in order that our time might correspond with that of England, to have two days following of the same date, and by this means lose the time we had gained and still were gaining, as we sailed to the eastward. We had, therefore, two Thursdays and two twenty-fifth days of November (1841) in succession; so that, after crossing the meridian, and having made the alteration of a day, instead of being twelve hours in advance, we became so much in arrear of the time in England, which would gradually diminish as we pursued our easterly course, until on our return we should find them in exact accordance. Had we not made this alteration, our Christmas Day and New Year's Day would have been one day earlier than in England. It is fortunate that we did not cross into west longitude on either of those days, for two such holidays in succession would have been a still more novel circumstance. From this it will be seen that at the 180th degree of longitude on an eastern course two successive days must be of the same date, and on a western course at the same degree one day must carry two dates.

(*To be continued.*)

PRACTICAL INSTRUCTIONS TO JEWELERS, SILVERSMITHS AND ELECTROPLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. XVI.

(Continued from page 3.)

Electro-Tinning.—There are a number of tin solutions recommended, but most of them give either unsatisfactory results, or are difficult of application or too costly. A tin solution to be practical must secure a solid deposit and perfect whiteness, and at the same time be cheap and easily manipulated. Experience has taught me that these qualities are united in the highest degree in the following bath :—

Rain, or better still, distilled water, 110 gallons;
Pyrophosphate of soda or potash, 11 pounds;
Crystallised protochloride of tin, 21 ounces;
or, in preference, of the same salt fused, 18 ounces, in order to avoid an excess of acid.

The water is put into a tank entirely lined with anodes of tin sheets, united together and connected with the positive pole, carbon or copper, of the battery. Then introduce the pyrophosphate of soda or potash and stir it in; when dissolved the protochloride of tin is put into a copper sieve half immersed in the solution. A milky white precipitate is produced, which disappears after continued agitation, leaving a colourless or slightly yellowish liquid. The bath is then ready. Place the previously cleansed objects upon transverse metallic rods connected with the negative pole. The anodes are not sufficient to keep the bath saturated. When the deposit is too slow add small portions of equal weights of tin, salt, and pyrophosphate; put in by the aid of the sieve, as if fragments of protochloride of tin fall to the bottom of the bath they become covered with a crust, which prevents their solution. The tinning thus obtained upon any kind of metal is quite resisting, and has a white and dead lustre resembling that of silver. A bright lustre may be obtained with the scratch-brush or the burnisher. As the reduction of these baths requires an intense current, and the working of the batteries is expensive, I prefer the third method of tinning, *i.e.*, by substitution or double affinity; in fact, this method is at present almost exclusively practised in our workshops.

Tinning by Double Affinity.—The tinning bath may vary considerably in composition, but I give two formulæ which secure quick and certain results. Of the two I prefer the second, its only drawback being that the salt used is not always obtainable of a uniform composition. The bath is composed of—

1. Distilled water, 66 gallons;
   Cream of tartar, 6½ pounds;
   Protochloride of tin, 10½ ounces.

The powdered cream of tartar is dissolved in 44 gallons of warm water, and the tin salt in 22 gallons of cold water. The two solutions when mixed become clear, and the resulting bath has an acid reaction—

2. Distilled water, 66 gallons;
   Pyrophosphate of potash or soda, 13 pounds;
   Protochloride of tin, crystallised acid, 21 ounces;
   or, the same fused, neutral 14 ounces.

The whole is dissolved at the same time on a metal sieve, and, after stirring, the bath is clear. Either of these solutions is kept in a barrel with the top off. This barrel has at its lower part two tubes placed one above the other, connected with a small boiler built below the level of the bottom of the tank. The tube, starting from the bottom of the tank, reaches nearly to the bottom of the boiler; the other tube, which is placed about 3 inches from the bottom of the tank, is connected to the top of the boiler; a bent safety tube, connected only to the boiler, prevents any explosion, should there be an obstruction in the other tubes. A small quantity of water or mercury in the bent arm of the safety tube will prevent the escape of steam when it does not exceed the working pressure required. When the boiler and tank are filled with liquid, as soon as heat is applied the expanded and lighter liquid will rise through the upper pipe into the barrel, while the colder and denser one will flow into the boiler through the lower pipe. A continual circulation is thus obtained, which keeps up a constant agitation of the contents of the bath. Large pieces are cleansed and rinsed, and piled in the bath with a few fragments or spirals of zinc; the surface of the zinc should be about the thirtieth of that of the tinned articles. For small objects, such as pins or hooks, dispose them in layers about an inch thick upon perforated plates of zinc, which allow of the circulation of the liquid, and have their edges turned up so as to prevent the objects from falling off. These plates should be removed from the bath in the inverse order in which they have been put in. These zinc plates must be scraped and cleaned, so as to present fresh surfaces of zinc instead of the white crust, which prevents its contact with the articles to be tinned. The time for the operation varies from 1 to 3 hours. Then remove all the objects, and add to the bath 9 ounces of pyrophosphate, and as much of fused protochloride of tin. Whilst the solution is going on, scratch-brush the large articles, and stir the small ones about with an iron fork, to change the points of contact. The objects are then again steeped in the bath for at least 2 hours. The large pieces are scratch-brushed again, and the small ones rendered bright by mutual friction. Then dry the whole in dry and warm fir-wood sawdust. Cast-iron cooking vessels thus tinned have a bright appearance, and have the advantage of never communicating any taste, smell or colour to the food cooked in them, even when the tinning, after long use, has completely disappeared.

If the tin deposit is grey and dull, although abundant, charge the bath, once or twice, with the acid crystallised protochloride of tin; if, on the contrary, the deposit is very white, but blistered and without adherence or thickness, replace the acid salt by the fused one. In the latter case, also diminish the proportion of tin salt, and increase that of pyrophosphate. As a great deal of the success of the operation depends upon the quality of the pyrophosphate, I shall give directions how to produce it when treating of the chemical substances used in electro-metallurgy at the conclusion of the present articles. When a tinning bath has been worked for a long time, decant the liquor to separate the pyrophosphate of zinc formed. And when, after several years, the solution is entirely used up from the alteration of the salts, it should be kept in preserving tubs, where the objects to be tinned are put after cleansing.

(To be continued.)

Cheap Clocks.—A man is actually grumbling because his Swiss clock, for which he paid 2s. 6d., is not keeping perfect time. He states that "it starts off at a rapid rate, watch fashion, and goes about three times as fast"; and implores the editor of a contemporary to assist him in regulating this impetuous clock. We think that the party was very lucky in obtaining such an amount of "going" for his 2s. 6d.

Quacks in the Trade.—The following query appeared in a recent issue of one of our "jack of all trades" journals: "I have a Geneva watch that will not go above fifteen minutes at a time. As often as I start it, it will not go above that period, and I have just had it cleaned up. I should be very glad if any of your readers will tell me the cause and how to alter it.—Small Jobber." Will anybody take pity on this *small jobber*?

SILVER TRADE.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Mr. Editor,—The relations between the Goldsmiths' Company and the makers and sellers of articles in the precious metals are at present in an ill-defined and most unsatisfactory condition. In proof of this we need only refer to the often recurring questions in Parliament, and to the leading articles and other notices in the chief newspapers of the day. Rumours more or less authentic find their way into print of breaches of the law by the selling of goods fraudulently marked as having been made at a date, the genuine productions of which are now by a freak of fashion valued at many times their original cost.

The public have been let know in fits, and by scraps of information, that a certain dealer, whose name is a very open secret, sold 647 pieces of silver plate to a wealthy banker as genuine productions of Queen Anne's reign, but which were found on examination by an expert to be every one of them marked in a manner which constitutes a forgery in the eye of the law.

Ordinary English folks have, in the present day, an idea which would take a good deal of hard experience to shake out of them, that no delinquent is beyond the reach of the law, yet we are passing through month after month since this fraudulent dealing was first made known, and we have heard how the Goldsmiths' Company, exercising the powers confided in them by the State for the protection of the public, have demanded of the dealer the sum of £6,470, being at the rate of £10 of penalty per article as by law directed. But we wait in vain for the further intelligence that the authority which acts so promptly when a manufacturer has the misfortune to mix his silver one pennyweight wrong, has, in the case of the delinquent dealer, enforced the legally inflicted fine. In this law-abiding country we are so accustomed to have execution follow speedily after conviction, that we naturally conclude there are special causes at work preventing the usual course from being followed out to the end in this notorious case. It may be worth while to give up a little time and space to a consideration of the law as it at present stands, and also to the history and constitution of the body which should enforce that law but does not.

We can have no better authority on the law under which the Goldsmiths' Company works, than that of Mr. Prideaux, who told the Commons' Committee that he commenced his business life at the Goldsmiths' Hall in 1829, and who has been clerk, and consequently the legal adviser to the company for now 28 years. Sir H. Jackson, chairman of the Committee, asks Mr. Prideaux, Question 1529—"When were dealers, as distinguished from workers, first brought within the law?" Answer—"The word 'dealer' is first used in the 7th and 8th of Victoria, chapter 22, which is the Act under which all our proceedings for offences, and all our proceedings for penalties are instituted, and that is a very important Act of Parliament. The 3rd section provides that 'Every dealer who shall sell, exchange, expose for sale, export, import, or attempt to export or import, or who shall have in his possession without lawful excuse (the proof whereof shall lie upon him) any ware of gold or silver, or base metal, having thereupon any forged or counterfeit mark, or any mark which shall have been transposed or removed, is made liable for every such ware to a penalty of £10'; that is the clause which enables the Goldsmiths' Company to sue a dealer for a money penalty without proving a guilty knowledge; that is one of the most important clauses we have in the Act. I was consulted in the preparation of this Act of Parliament. The great difficulty of the Goldsmiths' Company at that time was the proving a guilty knowledge of a forged mark, in fact, we hardly ever succeeded in our prosecutions unless we found the marks themselves. A man has sold a thing with a forged mark upon it, but there is a very great difficulty, particularly in a prosecution for felony, to persuade a jury that the man did it knowingly. In our communications with the Board of Trade it occurred to us that a dealer is bound to know his business, and therefore we asked the Legislature to give the Goldsmiths' Company the power of suing a dealer for a penalty, if he sold wares with forged marks upon them, without the necessity of proving a guilty knowledge. A subsequent section of the Act took away any apparent hardship on the dealer from that proceeding, by providing that in any case in which he proved from whom he had obtained the articles, he should be exempt from the penalty." This most clear exposition of the law as it stands, defines the duty of the company's executive in a way which does not admit of doubt or ambiguity, and we have the further evidence of Mr. Prideaux as given in Answer 1531 "that in looking back for ten years we have prosecuted six people for felony and forgery, proving a guilty knowledge, and we have succeeded in all these prosecutions but one, where the jury gave the man the benefit of the doubt."

It is clear, then, that the Act has been found to serve the purpose for which it was framed, and that offenders have been successfully prosecuted in almost every instance; how is it then that the fine has not been levied from the great offender whose case has been so much commented on for months past? And how is it that the Goldsmiths' Company instead of learning from the vendor who was the maker of the fraudulently marked articles, have been offering a reward of £100 to any person who will disclose his name?

Answers have already been offered to the public in the newspapers, and they briefly amount to this, that the dealer in question replies to the demands of the Goldsmiths' Company to this effect: "If I have broken the law, so have you, and I challenge you to take my case into court, and I am prepared to prove that you have forfeited all right to prosecute me under your charter, because of the illegalities you yourselves are guilty of in the annual elections of your wardens."

On the authority of Mr. W. Herbert, Librarian to the Corporation of London, whose standard work on "The Twelve great Livery Companies of the Corporation," has been consulted, a brief sketch is here given of the origin and purpose of the company's charter.

The first ordinance for the regular governing of the company was the charter granted by Edward III., which was given under the common plea usually advanced at that period, the prevention of abuses in the trade by foreigners introducing adulterated wares, and the non-observance by many of the London goldsmiths of former ordinances. The king therefore directs, "That those of the said trade may, by virtue of such letters patent, *elect lawful, honest, and sufficient men, best skilled in the said trade*, to enquire of the matters aforesaid, and that they so chosen may, upon due consideration of the said craft, reform what defects they should find therein, and thereupon inflict due punishment upon the offenders, by the help and assistance of the Lord Mayor and sheriffs of the said City of London if need be." By further letters patent the same king confirmed and extended the privileges of the company, defining the time and mode of electing the governing body of the craft, and also conferring to them the right of search for articles made and sold in contravention of the statutes. In the following reign the goldsmiths represent to Richard II. by petition that the letters patent granted by his grandfather could not be put in execution, from their "*not naming persons capable*," whereupon the king gave them a letter patent in confirmation which "*Grants and licences the men of the said craft that henceforth they may be a perpetual community or society amongst them-*

selves. And that the said society or company may for ever, yearly, elect out of themselves, four wardens, to oversee, rule, and duly govern the said craft and community, and every member of the same." These charters are afterwards recited and confirmed by letters patent from various sovereigns down to the reign of James I., and by them the company's proceedings are authorised up to the present hour.

It is clearly then a question of first-rate importance in the controversy about the company's course of action, how far it has complied with the provisions of its charter in the election of wardens.

The law enacts that there shall be elected each year to govern the company, four wardens; the practice is for the warden who is at the bottom of the list this year to be third from the top next year, second the year after, and prime warden in the fourth and last year of his wardenship. The law is perfectly clear in providing that they shall be men "best skilled in the said trade":—let us see how this wise provision is carried out. During the last eleven years, at the rate of four per annum, forty-four individual elections have taken place, ten only of which have fallen upon gentlemen who can by any stretch of courtesy be reckoned as belonging to the trades in precious metals; these ten elections fell on three individuals, one of whom, Mr. Matthey, was an assayer of metals, another was Mr. Pixley, a bullion broker, and the third who is now in office is Mr. Thomas, who deals extensively in silver plate, especially of the second-hand kind. In each year of the eleven, with the exception of 1877-8, one or other of these three gentlemen has been a member of the wardens' court. In the year 1877-8 the wardens were, Mr. Bramwell, civil engineer; Mr. Copeland, porcelain manufacturer; Mr Norbury, stock broker; and Mr. Fleming, merchant. It is contended that these elections of gentlemen unconnected with the trades in question are in direct contravention of the letter and spirit of their charter, and that the court of wardens have thereby absolved the said trades from their allegiance to them.

It is evident that action must be taken, and that speedily, to clear up a question which is of vital importance to the trade.

The position and reputation of the gentlemen composing the court of wardens and assistants, comprising among others an ex-Lord Mayor, several magistrates, and also gentlemen holding the honourable positions of directors in the great joint-stock banks, render it impossible that they can with credit to themselves abstain any longer from vindicating themselves in the eyes of their countrymen, either by enforcing the law, or by abandoning a position which is not theirs by right, if the allegations of their opponents be well-founded.

It is a general impression among the public that the Goldsmiths' Company is composed exclusively of persons engaged in the trades; if this illusion could be speedily dispelled it would greatly hasten forward the time when the unfortunate silver trade will be emancipated and put on a sound basis. To throw some light on the various aspects of the question is the earnest desire of

An Old Hand.

Sheffield, 29th July.

THE GOLDSMITHS' AND SILVERSMITHS' FREE TRADE ASSOCIATION.

At a meeting of the "Goldsmiths' and Silversmiths' Free Trade Association," held last week, at the office, 12, Pall Mall East, the chairman, Mr. E. J. Watherston, presented the returns of the Board of Inland Revenue, showing that the silver plate upon which duty was paid in the year ended March 31, 1880, amounted only to 638,620 ounces, or to 101,619 ounces less than last year. The following figures show the serious decline in the silver trade during the last six years:—In 1875, the amount manufactured was 886,493 ounces; in 1876, 870,507 ounces; in 1877, 798,206 ounces; in 1878, 783,151 ounces; in 1879, 740,239 ounces; and in 1880, 638,620 ounces; or a total fall in six years of 247,873 ounces. The exports in the same period also show a serious decline of 35,787 ounces. It was stated that the decline in the manufacture was to be attributed to the agitation for the repeal of the duty, as manufacturers were unwilling to add to their duty-paid stocks; that in exports was caused by the superiority of American silver ware, and the increased demand for American productions in the colonies.

It was resolved unanimously to ask the Chancellor of the Exchequer and the President of the Board of Trade to receive a deputation early in the month of November, with a view to obtaining free trade legislation in the next Session of Parliament.

REGISTRATION OF TRADE MARKS AND DESIGNS IN ITALY.

Messrs. L. A. Groth and Co., of the Scandinavian Patent Office, communicate the following:—

"The Court of Cassation of Turin, under date of March 3rd, 1880, has sanctioned the following resolutions in regard to the law of the 30th August, 1868, concerning the registration of Trade Marks and Designs, which is applicable and favourable to all foreign manufacturers.

"1st. 'When a Mark or Sign presents a similar character to any other symbolical characteristic, for example, the name and signature of the inventor, and the name of the place from whence the goods arrive, and to which the Marks or Signs are attached. A foreigner, who lawfully uses the same Mark or Sign in his own country, may also have the exclusive right to use the same in the Kingdom of Italy by conforming himself to the prescribed law, passed the 30th of August, 1868, regarding the registration of Trade Marks and Designs.

"2nd. 'That any use of such a Mark or Sign, or the same being published and promulgated in the Kingdom of Italy previous to the obtaining of the necessary certificate of protection, shall be considered as a violation of the law, and no exclusive right to use any Mark or Sign will be guaranteed after such Mark or Sign has thus fallen into public hands.'

"The result of the above resolution being that all foreign manufacturers or merchants who first register in Italy their distinctive Trade Mark or Sign will be able to obtain the protection of the same by law, and a guarantee against any infringement whatsoever."

Forged Hall Marks.—On the application of Mr. Besley, barrister, Mr. Mansfield ordered process to issue against a dealer for having altered silver plate bearing forged hall marks of the Goldsmiths' Company. It was alleged that he had obtained from a gentleman more than double their value for newly manufactured goods by so manipulating them as to make them appear of the date of Oliver Cromwell, the forged hall marks contributing materially to the deception.

Pearls in New Zealand.—The Auckland *Evening Star* reports the discovery of pearls in Oakley Creek, New Zealand. While passing along the bank of the creek, Mr. Benjamin Gittos, an old resident of the district, observed a peculiar and, to him, new shell-fish in the sand. A little search disclosed a large number of them of various sizes. The inner coating of the shell was found to be mother-of-pearl of fine quality, and in several of the larger shells he found loose pearls. The pearls are described as unusual in form and colour, not perfectly round, but far more brilliant than ordinary pearls.

A FEW WORDS ON GEMS AND PRECIOUS STONES.

By Edward J. Watherston, F.S.S.

(*Continued from page* 158, *Vol.* V.)

THE belief in precious stones as "charms," dating back to the most remote ages, is still flickering at the present time. It exists yet "in parts of our Indian empire, and is said to be notably strong in Persia." That august visitor to our shores, the Shah, has, on good authority, a number of gems in the possession of which he puts the firmest faith, as a protection against all earthly ills and misfortunes. Accidental circumstances perhaps helped to strengthen this faith, for on one occasion the bullet of a would-be assassin glanced off from the casket of jewels which the "King of Kings" wears always on his breast. It may be that, on this account, the Shah of Persia has come to be the proprietor of the largest collection of jewels in the world, the total being valued at from three to four millions sterling.

In all ages precious stones have had strange powers ascribed to them, and one of the most pleasing which exists in most countries is that each month is represented by a particular stone.

Thus arose the custom amongst friends to present each other with some trinket set with their tutelary gem. The ancients called them zodiac stones, and often had them set together as amulets to derive the benefits each could confer, and thus circumvent fate.

January, Aquarius, Jacynth.—Constancy and fidelity in every engagement.

February, Pisces, Amethyst.—A preservative against violent passions; also denotes peace of heart.

March, Aries, Bloodstone.—Courage and wisdom in perilous expeditions, and firmness in affection.

April, Taurus, Sapphire.—Frees from enchantment, and denotes repentance and kindness of disposition.

May, Gemini, Emerald.—Discovers false friends, and ensures happiness in love and domestic felicity.

June, Cancer, Agate.—Causes its wearer to be invincible in all feats of strength. Ensures long life and prosperity.

July, Leo, Ruby.—Discovers poison; also ensures the cure of all evils springing from the unkindness of friends.

August, Virgo, Sardonyx.—Ensures conjugal felicity.

September, Libia, Chrysolite.—Preserves from despair.

October, Scorpio, Opal.—Denotes misfortunes and hope.

November, Sagittarius, Topaz.—Promises that rare thing, "Friendship."

December, Capricornus, Malachite.—Prosperity in love.

What more fitting ornaments than Porte Bonheur bracelets and rings can be devised for Birthday, Christmas and New Year's Gifts.

Gems as Medicinal Agents.

The admiration of precious stones, as being able to cure diseases of all kinds, though of later date than the faith in the jewels of the "breastplate of the High Priest," mentioned in Exodus, and the "highest gift of Heaven" according to Orpheus, was none the less equally strong and lasting. But it is notable that while the belief in gems as "charms" evidently had its home in Asia, the only producer of them for many centuries, the faith in precious stones as medicinal agents originated among the ancient Greeks. This is made tolerably clear by the utterances of most of the classical authors of Greece, more particularly so by numerous expressions in the before cited poem of Orpheus "On Gems." According to Greek legends, the curative power of precious stones was first discovered through their being found in the head of serpents, or of "vipers." It is thus, sings great Orpheus:—

> "For all the ills that out of earth arise,
> The earth herself the antidote supplies,
> She breeds the viper, but she, too, gives the sage
> The very means to quell the viper's rage.
> All sorts of gems spring from her womb so wide,
> Which ailing mortals with sure help provide.
> For all the virtuos potent herbs possess,
> Gems in their kind have, nor in measuro less.
> Great is the force of herbs, but greater far,
> The virtues that in stones inherent are.
> For in the stone implanted mother earth,
> Eternal force unfading from its birth.
> Short-lived are herbs; they quickly fade away,
> And but in life their potency hear sway;
> When past their prime they dry and withered lie,
> And little help there is in things that die.
> Herbs as the source of life and health we own,
> But everlasting life exists in stone,
> As num'rous as the flow'rs spring from the ground,
> So many gems are in earth's bosom found."

Orpheus enumerates twenty-seven gems as cures "for all the ills that out of earth arise," placing at the head of the list the "crystal," probably the ruby, which he calls the "transparent image of eternal light," and in the second rank the "Adamas," or diamond, so named from its hardness, which gave rise to the expression of "adamantine chains." In both the Greek and the Roman writers there are endless references to the curative power of precious stones. From many of the allusions it appears that the dictates of fashion here, as everywhere else, had much influence over the prevailing belief in the virtue of particular stones, now one and now another being held up as specially efficacious for the cure of certain diseases. Thus, while the "Crystal" and the "Adamas" stood for a long time among the Greeks at the head of medicinal agents, that position was afterwards assumed by the "Sardius," or the Oriental carnelian. "No other stone," records Pliny, "was so great a favourite with the Greeks as this, and the plays of Menander and of Philemon abound in allusions to it." The cause of this favouritism lay probably in the facility with which the carnelian could be cut by the engraver, the dull red, flesh-coloured stone offering by itself no other attractions. Such engraved stones, either in the form of intaglios or of cameos, constitute to some extent an epoch in the history of gems, as it modified the original idea of stones being possessed of inherent virtues. To this came now to be added the conception that these powers might be raised, or changed, by pictures and inscriptions from the hand of the engraver.

(*To be continued.*)

Expansion of Metals.—According to some recent experiments of M. Goulier, the coefficient of expansion by heat of a metal is independent of any pressure put upon the metal, and is the same under a tensile strain as under one of compression.

Clock wanted in Clerkenwell.—"Vigilant," in the *Clerkenwell Press*, says:—"One of the funniest things I have ever witnessed was the look of disgust which stole over the faces of the members of the Clerkenwell Vestry when it was proposed on Thursday last that an "American" clock should be purchased for the use of the superintendent of the wharf. Those connected with the horological industry rose to their feet in dismay; had it come to such a state of things that even Clerkenwell—the metropolitan home of their industry—had to go to a foreign country for a timepiece? At length their troubles were allayed by the word "English" being substituted for "American," but even then it was impossible for the members to agree as to the price to be paid, and those who listened to the diversity of sums which were given as the value of a first-class clock must have wondered how much percentage of profits are reckoned upon by some of the manufacturers of these articles.

TECHNICAL EDUCATION.

APPRENTICESHIP: SCIENTIFIC AND UNSCIENTIFIC.

By Silvanus Phillips Thompson, D.Sc., B.A.,

(*Continued from page* 10.)

IT is astonishing how little progress has been made in the forms of the commonest hand tools for hundreds of years.[*] The hammers, the saws, the chisels have not changed since the days of William the Conqueror; yet there is room enough for improvement.

I have just now said that the essentials of success in the rational and scientific apprenticeship are good teachers and a good system of instruction, in which prominence is given to drawing and to the science of tools. These are the practical essentials; but there is one thing more essential still. We must first convince those most concerned that there is an absolute and imperative necessity for this entire reform.

There is no question whatever but that the persistent neglect of technical education in England will sooner or later ruin her in the markets of the world, which will be seized by less favoured but more highly trained nations. And the work of technical education is only half begun if it stops short of regenerating the education of the apprentice.

An organism which, having grown up under certain external conditions, finds the conditions which environ it changed, must adapt itself to those new conditions or perish in the struggle for existence. If it fail so to adapt itself, it is doomed. Human institutions differ from organisms, however, in so far as the powers of the human race transcend those of lower creatures. Man has not only the power of adapting himself to external circumstances, but, in some cases, of adapting the external circumstances to himself, by virtue of his intelligent command over the blind forces of nature. Hence, in the struggle for existence of human institutions, every change, every new development, is the result of a compromise, as it were, between those external forces which man can change and those which he cannot. The old apprenticeship was a system which grew up under certain external conditions, which the lapse of time and the growth of science have changed for ever. It is virtually defunct, and all our best efforts to revive it could but galvanise it into unhealthy and spasmodic activity for a few brief years. We can no more exchange the existing social order of things for that of six centuries back than we can roll back the Thames from London-bridge to Oxford. To that new order of things our commercial and industrial institutions must conform, or they will find themselves distanced irrevocably in the struggle. The skilled industries of Great Britain, with their irregular bands of workers, trained anyhow, nohow, armed with fantastic scraps of empirical knowledge, and swaddled up in rules of thumb, are doomed before the industries of nations who bring into the field ordered legions of trained workers equipped with intellectual weapons, and clothed with sound science. Against such adversaries all the stores of coal and iron in our hills and valleys will be of little avail. We have, however, one chance left; we must adapt our systems to the new social order, and organise and drill and train our workers in a systematic and scientific apprenticeship, in accordance with the dictates of right reason, and in harmony with the spirit of the age.

Crystallised Silver.—Mr. Swan, curator of St. George's Museum, Walkley, quotes from a letter which he had received from Mr. Ruskin: "I send you to-day a piece of 'metal-work' which I think deserves to be at Sheffield—as, I hope, Sheffield will prove deserving of it. I have never seen so beautiful a piece, . . and, as the specimen is the first I have found to prove my assertion that all stalactitic forms are crystalline, I am well content to be amerced in this sum (i.e., the price paid for it). The lustrous surfaces of this silver are the finest pieces of crystallisation I ever saw of the metal; and the system of crystals throughout perfectly visible. It must be kept with extreme severity in its glass to prevent tarnishing, which exposure to air and sulphuretted hydrogen would do in six months. I fear *nothing* will prevent its yellowing and losing much lustre; but its mineralogical value will be always the same."

The Brittleness of Emeralds.—A case was decided at the Westminster County Court a few days ago which has considerable importance for those who are fortunate enough to possess valuable emeralds. Dr. Lynn, the well-known conjuror, was summoned to make good the value of an emerald ring which had been entrusted to him at one of his entertainments by a visitor for the performance of a certain trick. Somehow or other, the stone became broken, and the allegation of the plaintiff was that the damage had been done by Dr. Lynn himself, while smashing with a hammer the egg in which the ring was finally found. Now, it says much for the cleverness with which the trick was performed, that the plaintiff firmly believed his ring to have been somehow smuggled into the interior of an egg. Of course, this was not really the case; the adroit *prestidigitateur* had the trinket elsewhere all the time, and only made it to appear as if coming out of the broken egg. However, there was no doubt about the stone being broken, and the sole thing, therefore, was to ascertain how it came by the injury. Only at one stage during the whole trick was the ring subjected to the slightest violence, and this was when Dr. Lynn received it from its owner into a glass receptacle that already contained several coins. If the ring was either thrown in or let drop so that the face of the emerald struck against an edge of one of the coins, the blow might have been sufficient to cause a fracture, especially if the stone had a flaw previously. Almost all emeralds are more or less flawed; indeed, it is doubtful whether such a thing as a perfectly flawless emerald has ever been known. The chances are, therefore, that the gem in question was in this imperfect condition, and that the concussion consequent upon its fall on to the coins completed the fracture. Such, at all events, was the judicial decision in the matter, and Dr. Lynn carried the day. But, warned by experience, he now always makes an exception in the case of emeralds when he is asking for the loan of a ring. Not all the magic of the conjuror's art can piece together a fractured precious stone; that feat beats Dr. Lynn himself, marvellous as are some of his manipulations. And as it is just possible that some county court judge might hereafter believe, as did the plaintiff in question, that this Piccadilly wizard has the power of wafting trinkets into the interior of unbroken eggs, emeralds will probably play no further part in conjuring performances.—*Globe.*

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[*] We have heard lately of certain new American saws having alternately two long teeth between short ones, and denominated "Lightning Saws" from the speed with which they can be used for coarse work. But the "Lightning Saw" is at least three hundred years old. Had we had a science of tools every professor of that science would have had such in his knowledge, if not in his actual possession, at any rate as an historical curiosity, if as nothing more. During a recent visit to Germany, I had occasion to visit and examine a fine series of etchings by the great master, Albrecht Dürer. One of his most famous productions in that line of art is the picture known as the "Melancolia." It is dated 1514. It shows a melancholy woman resting from labour. On the floor beside her lie a plane, a hammer, and a saw of the type quoted.

HINTS TO REPAIRERS.

(*Continued from page* 8.)

AFTER the hints we have given in the last few chapters, we have no doubt that any intelligent workman will be able to restore an old-fashioned clock. We have never seen a clock of this class, however old, but could, with judicious care, be put into condition to do service for another generation, and preserve to their owners all the hallowed memories of the past that may be associated with the clock. We conclude the present subject with a few instructions in the silvering of dials, which will no doubt proveuseful to many.

Purchase nitrate of silver, sold by the druggists in the form of sticks about three-sixteenths of an inch thick and three inches long, such as is used for medicinal purposes and called lunar caustic. Dissolve such a stick in half a pint of rain water in a perfectly clean tumbler; add two or three table spoonfuls of common salt, which will at once precipitate the silver in the form of a thick white curd called chloride of silver. No harm will ensue if an excess of salt is used. Let the chloride settle until the liquid is clear; pour off the water, taking care not to lose any chloride. Fill the tumbler again with water and thoroughly stir with a clean bit of wood and again pour off, which process repeat till no trace of salt or acid can be perceived by the taste. After draining off the water, add to the chloride about two heaped tablespoonfuls each of salt and cream of tartar, and mix thoroughly into a paste, which, when not in use, must not be exposed to the light.

To silver a surface of engraved brass, wash the surface clean with a stiff brush and soap. Heat hot enough to melt black sealing wax, which rub on with a stick of wax, until the engraving is entirely filled, care being taken not to burn the wax. With a piece of flat pumice-stone and some pulverised pumice-stone and plenty of water, grind off the wax until the brass is exposed in every part, the stoning being constantly in one direction. Finish by laying an even and straight grain across the brass with blue or scotch water stone. Take a small quantity of pulverised pumice-stone in the hand and slightly rub in the same direction, which tends to make an even grain; the hands must be entirely free from soap or grease. Rinse off the brass thoroughly, and before it dries lay it on a clean board and gently rub the surface with fine salt, using a small wad of clean muslin.

When the surface is thoroughly charged and covered with salt, put upon the wad of cloth, done up with a smooth surface, a sufficient quantity of the paste, say to a dial three inches in diameter a piece of the size of a marble, which rub evenly and quickly over the entire surface. The brass will assume a greyish streaked appearance; add quickly to the cloth cream of tartar moistened with water into a thin paste; continue rubbing until all is evenly whitened. Rinse quickly under a copious stream of water; and in order to dry it rapidly dip into water as hot as can be borne by the hands, and when heated, holding the brass by the edges, shake off as much of the water as possible, and remove any remaining drops with a clean dry cloth. The brass should then be gently heated over an alcohol lamp, until the wax glistens without melting, when it may be covered with a thin coat of spirit varnish, laid on with a broad camel's hair brush. The varnish or lacquer must be quite light coloured —diluted to a pale straw colour. There is a certain dexterity and judgment required, which may, however, be easily acquired with practice.

(*To be continued.*)

A HANDY WAY TO REPLACE A WORN-OUT SQUARE ON A WINDING ARBOR.—If the old square is not already too thin, file nearly round and cut a good thread in a screw-plate; take a piece of square steel and drill a hole into it somewhat smaller than the thickness of the screw, and tap with a hardened screw-drill; countersink the lower end in order to fit well, fix the piece on to the screwed arbor and finish off, when the new square will answer every purpose. For a going barrel make a right hand, and for a fusee a left-handed screw. In case the square of the arbor is too much worn to allow filing round and yet leave a sufficient body for screwing, cut it entirely away, and drill a hole in the centre of the arbor; take a piece of hardened square steel, slightly conical at the end, drive into the hole and finish off. To ensure the utmost security, which, however, is not esentially required, the pieces may be soft-soldered in addition to the fastening by screwing or plugging. The same manipulation will answer for squares to fit on the stopfinger on stopworks of Geneva watches, or the square holding the ratchet on main-spring barrel of fusee watches, also for French clocks, musical boxes, &c. These auxiliaries may perhaps be condemned by some watchmakers who strictly maintain the necessity of replacing every damaged part of a watch by an entirely new piece; but after giving the arbor merely once a trial, will no doubt be adopted, as it combines efficiency with economy.—H. BUSH, Hull.

CAUTION.

A PROVINCIAL correspondent informs us that a man, dressed in deep mourning, is going about, offering a flat necklet, Albert (open curb), stamped 15 carat, and an Alma pattern Victoria, which are simply 10 carat gilt, but represented to be 15 carat at least.

The *Pawnbrokers' Gazette* of the 19th ult. states :—"Early in the past week, a Gold Albert Chain, fetter link pattern, with forged 15 carat hall-mark on each link, was stopped by a London pawnbroker, who only discovered that the chain was plated just as £5 was being lent on it. £6 was asked, but the former sum readily taken. The chain is remarkably well got up, and weighs nearly 3 ozs. A genuine gold locket, with inscription "Mizpah," was attached, the latter probably worth 15s."

IMITATION OF OLD SILVER.—The *Revue Industrielle* gives the following process for giving to any silver plated or silver article the characteristic appearance of antique plate. The article is dipped in a bath of water containing about 10 per cent. of sulphide of ammonium and then scratch-brushed with a brush made of glass threads or "bristles." When afterwards burnished with an agate tool its surface becomes a beautiful dark brown colour.

WHERE TO BUY A CLOCK.—We are now quite used to see clocks for sale at the ironmonger's, stationer's, and fancy goods dealer's; but in the shop-windows of bakers and coal merchants they are a decided novelty. The Tyne Main Coal Company supplies now as a special inducement to consumers of coal, a *first-class* timepiece, *specially manufactured for them* (dials are very tame things and do not object to names) at a great sacrifice. The bills of the firm state that *only one* clock can be supplied to each customer, but we dare say two might be obtained with a little persuasion. It is to be hoped that these timepieces are really reliable, otherwise they might irritate the temper of the purchasers and find a resting place in the receptacle devoted to Tyne Main coal.

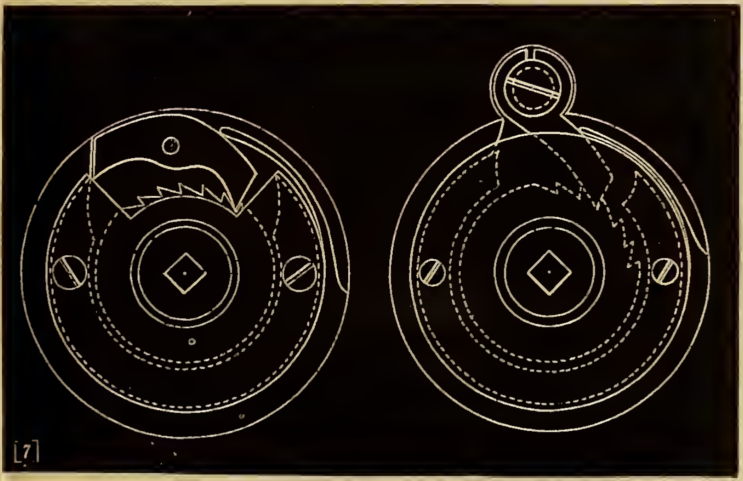
Only a few doors from one of the offices of this company in Essex Road, Islington, lives the enterprising baker who wishes to increase the income derived from dough by the sale of time. "We have had such numerous applications for clocks," say his placards, "that we have made arrangements which enable us to satisfy the wants of our customers on the most advantageous terms, etc. etc. It would appear from this announcement that the public had great trouble in obtaining clocks. What a considerate baker to help them out of this difficulty!

THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.*

By M. Grossmann, Watch Manufacturer,
Glashuette (Saxony).

(*Continued from page* 9.)

CONSIDERING the possibility of accidents by the breaking or loosening of this screw, it may be a better plan to adjust the click upon a circular stud, left in the middle of the sink, and to provide a flat-head screw, merely holding the click in its place (fig. 8).



Figs. 7 & 8.—Click-works Sunk into the Plate with Exposed Parts.

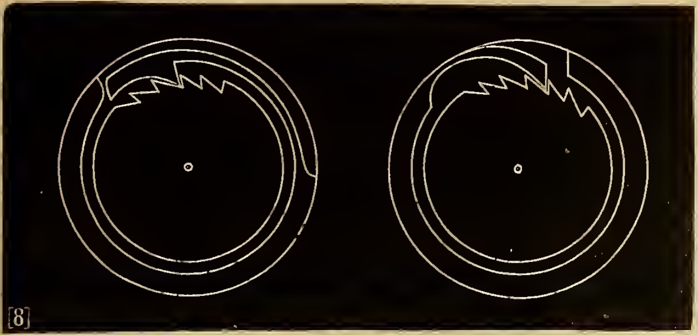


Fig. 9.

38. It would be a simplification of the click-work to form the click at the acting end of the spring, but the click and spring are very liable to break, and in such a case the replacing of the piece would be more troublesome.

39. The material of which the click-work ought to be made is hardened and well-tempered steel, at least for the ratchet and click. The spring might as well be made of another metal of sufficient elasticity, but steel is generally preferred, for the more striking appearance which its polished surface gives to the movement. The form of the ratchet tooth is not indifferent. It acquires a greater strength if its back is made a trifle convex, instead of quite straight. At the same time the acting extremity of the click is weakened; but this is, in case of wear, much easier to mend or to replace. The acting straight side of the ratchet tooth ought to be a little undercut, and a sharp and clean angle at the ground is of importance, in order that the resistance to the strain may be uniformly supported by the whole acting face of the tooth. The durability and good service of the click-work depends mainly on the good execution in these particulars.

It is also very important that the straight line drawn from the centre of motion of the click to its acting point be a tangent to the circumference of the ratchet, or, what is the same, that it stands at a right angle to the radius of the ratchet at the point of action. In case of a deviation from this right angle, it must be inward—that is, the angle must be obtuse, if the click is so arranged that it is pushed back by the action. If the click acts in a tractional way, the angle can be sharp. Fig. 10 shows several straight-lined click-works, frequently met with in Swiss watches, and against which no objection can be raised if properly and carefully constructed.

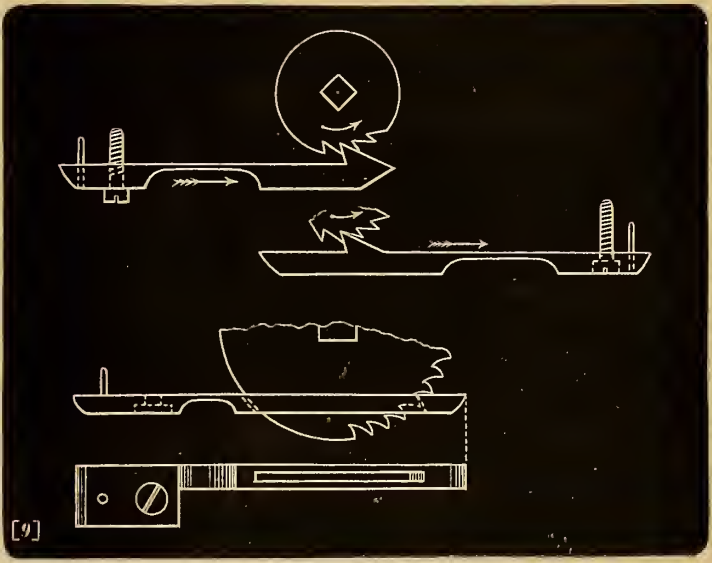


Fig. 10.

CHAPTER IV.

The Stop-Work.

40. The last of the accessories of the moving power is the mechanism regulating the amount of tension to apply to the spring in winding it, and the range of development of this latter to be employed for the daily march of the watch. This point, of all others, is the most open to controversy as to the best mode of attaining its purpose. In its execution there is great variety, from its total omission to the rather complicated but ingenious stop-works of some Swiss and French watches.

41. When we attempt to establish the rolative merits of those different constructions, there is an important feature which may guide our judgment, viz., friction. All stop-works, whose parts move under control of a frictional resistance, may be objected to, because friction, however slight it may be, is a useless loss of power; and should be avoided if possible. Besides, in all the stop-works of this kind, it is a tooth or finger only, which, by butting against the full part of the stop-wheel, puts an end to the winding; this tooth or finger is liable to break under the strain it may be subjected to by the careless way in which many people wind their watches.

(*To be continued.*)

Discovery of Gold Coins and Plate.—A number of gold and silver coins, together with silver plate, was recently found by some workmen in an old chimney-shaft in Leicester Square. The valuables appear to have been in their hiding place for many years. The plate, which was perfectly black, is of rare workmanship. Altogether there are 22 pieces, consisting of candelabra, centre-pieces, vases, cruets, &c., and the weight is 293 ounces. The coins belong to several reigns, from Charles II'.s down, and are in a good state of preservation. The Treasury officials have taken possession of the articles.

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THE ART OF THE SILVERSMITH.

By W. Herbert Singer.

(*Continued from page* 159, *Vol.* V.)

ABOUT this time lived that remarkable monk artist, Theophilus, who deserves to rank high amongst the art-workmen of old, for his wonderful treatise upon the various arts. Six of his manuscripts are extant, and in sixty-nine chapters he deals with the art of the silversmith. Unfortunately, he has fixed no date to his learned essay, and many of the best authorities have not been able to agree as to the age in which he lived. Some witers, such as Lessing, believe him to have lived as early as the ninth century; whereas the Abbé Texier, and others, reasoning from the knowledge he displays of glass painting, select the thirteenth as the period at which this work was produced. It is probable that the former have gone back too far, and that the latter assign too modern a date to the time of the monk's researches; for from the style of the work, and the terms he uses, it is more likely that he lived about the middle of the twelfth century. He mentions, in the preface, that "the Germans only, among the nations of the west, were famous for their skilfulness in the working of metals." He could not have written this much after the above-mentioned period, as, towards the end of the century, the French had quite equalled, and the Italians had probably surpassed them in their knowledge of metal working. This learned monk is so humble as to his own skill, and mentions so few facts with regard to himself, but so much of the arts in which he was so proficient, that it cannot even be decided as to what nation he belonged. He commences his chapter on the working of the precious metals by mentioning the different tools that were required, and then goes on to minutely describe the various processes that it was then necessary for an artistic metal-worker to be skilled in, the requirements being so varied that there are but few in our days who could fulfil them. He must be able to execute *repoussé* work in its many and difficult branches; also to engrave, and, if necessary, to compose the niello which is sometimes filled into engraved lines to produce a stronger contrast; to understand the mixture and application of *cloisonné* enamel, and the setting of precious stones; he must also be able to model in wax, so as to make the patterns for objects to be cast in silver or gold, which process he must also be able to undertake himself. We thus see, from the standard held up by this author artist—who, from the way in which he treats the different subjects, must have been himself able to produce work in the various processes he describes—that, by the end of the twelfth century, the silver smiths had mastered nearly every difficulty of their beautiful art. It is, therefore, the more disappointing that so few specimens of this period have descended to posterity, most of the examples still extant being of German origin, consisting of either shrines or reliquaries. The treasures of the cathedrals of Cologne and Aix-la-Chapelle are very rich in work of this time; in the former is the shrine of the three Magi, which was commenced in the year 1190; in the latter is still preserved the shrine of Charlemagne.

One of the most famous examples of this period is an object made in our own country, which goes by the name of the Gloucester candlestick. It is executed in a white alloyed metal, containing a good proportion of silver. This interesting specimen is still preserved in the South Kensington Museum. In outline, it follows the general design of these objects, having a straight stem, with a knop in the centre, a triangular base, and a large receptacle at the top to prevent the grease from dropping, with a pricker to hold the candle; but it is remarkable for the marvellous amount of decoration with which it is covered, every member being loaded with ornamental detail. This consists of volutes and foliage, in the folds of which are grotesque figures of men, birds, and monsters. This form of candlestick was to be placed upon the altar, but the churches at this time were furnished with others which stood upon the floor of the church. From the earliest days of Christianity it had been the custom to light a large candle at the great festival of Easter, as a type of the new dawn given by the Resurrection, and this larger candlestick was made to hold the Paschal candle.

I have not yet mentioned an object which has ever received especial care from the silversmith; I refer to the chalice. This interesting subject has not been spoken of at an earlier period, because, although there are records of the large number of chalices in use in the primitive church, we have but scant knowledge of their design and detail. In the first days of Christianity, the chalices were of great size, to allow for the large number of communicants, but, at an early date, there was also a small chalice in which the priest consecrated the wine, and, after his own communion, poured a small portion into each of the larger chalices, a sufficient quantity of unconsecrated wine being added. In many churches, these chalices were hung up on the wall, around the altar, by their handles.

The chalice has been made of various metals and substances, such as gold, silver, copper, tin, glass, wood, etc., but it was more often made of silver than any other material, that being the metal most adapted to its various requirements; and it was forbidden by an early Canon to make the bowl of anything but the precious metals, the inside of the bowl being always quite plain, and also some distance below the lip on the outside. In the twelfth century the cup was reserved to the celebrant, and from that time the chalice was made of a much smaller size. The large two-handled chalices were, no doubt, of classical shapes, but sufficiently altered to make them applicable to their new purpose. The smaller chalice, in the earliest period of which we have any example, is of a massive character, the bowl semi-circular, with a rather small round base, and thick stem.

The silversmith's art of the middle ages reached the greatest perfection during the thirteenth century, continued to flourish throughout the fourteenth, and slowly declined during the fifteenth century. With the dawn of Gothic art, the heavy lines of the Romanesque style disappears, and are replaced by those elegant shapes, the value of which consist in the beauty of their contour, and not in the cost of the material in which they are executed. This style is essentially ecclesiastical, and is perfectly adapted to the production of objects in the precious metals for the service of the church.

The pointed style of architecture marked a complete change in the silversmith's art. During the twelfth century, both the architecture and metal work of Europe had borne a resemblance, in many respects, to the productions of the Eastern Empire; but with Gothic art, that likeness entirely ceased. The artists who elaborated the wonderful pointed arch, together with the intricate tracery and columns of this period, had brother workers in the precious metals, who carried the art of the silversmith to the same pitch of excellence.

At the commencement of the century, we find that many of the silver objects then created, depend upon architectural detail for their enrichment. The little ornamentation with which such objects were decorated, was always exactly adapted to the shape in which it was placed, every part being especially designed for its own peculiar position. It was not, as in some periods of art, when the object was considered only as a means of showing off some elaborate combination of detail, of which the designer was so proud, that he would sacrifice beauty of form, and all else, so long as he was able to produce this specimen of his manipulative skill; in so doing, he often made his work almost worthless, by not observing one of the first rules of art, viz., that ornament is made for the object, not the object for the sake of the ornamentation.

During the next century, a great change again took place. The art of the silversmith now took a much wider range; hitherto, during the middle ages, it had been almost entirely restricted to the use of the church, and a great majority of the workmen had been inmates of the monasteries; but many of the objects now produced were for the sideboards of the nobles, and the art may be said to have almost forsaken the cloister, and to have fallen into secular hands.

A large quantity of the silver-work now executed was remarkable for its bizarre composition. This characteristic is most evident in the hanaps, fountains, ewers, nefs, and saltcellars. The articles for ecclesiastical use comprised chalices, crosses, censers, book-covers, burettes, and reliquaries.

In the preceding century, the reliquary almost always took the form of a miniature edifice; unless the work was destined for a cathedral, such objects now usually took the form of statuettes in silver, the general tendency of the age being towards the cultivation of sculpture, and this gave the silversmith an opportunity of displaying his skill in that art. The shape of the chalice also underwent a change. The bowl is made smaller, and is often semi-ovoid in form, the base being frequently divided into lobes, the knop being ornamented with architectural detail, and upon each side of the stem is often worked a small arch with cuspings, the proportion of the whole being excellent.

Of secular art, the saltcellar and nef seem to have claimed the greatest attention from the hands of the silversmith. By the frequent mentions made of the saltcellar in inventories of this period, its size and weight, and complicated design, it being composed generally of numerous figures, we learn in what importance it is held by a mediæval host. Salt was the emblem of hospitality, no guest being placed below the salt. Thus so significant a piece of plate had necessarily to be a conspicuous object.

The nef was a work which enabled the nobility to display their richness and luxury. In shape a miniature ship, which formed a receptacle to contain the goblet, and other utensils, for the use of the person to whom it belonged, it was placed in the centre of the table, occupying the position of the modern épergne. As an example of workmanship, the nef is most interesting, as every part was made with the greatest care. Thus the ropes, sails, etc., are all found in these minute vessels. Upon the deck men were often placed, and sometimes animals, these being executed with great skill.

It is curious to note that, while large and important objects are numerous, mention is made of only one fork in nearly every inventory of this time, this indispensable article being probably used for the first time about the middle of the fourteenth century, and then only for serving food from the large dishes.

There is but little to record of the silversmith's art in France during the Middle Ages. The first quarter of the fourteenth century was a most disastrous time to that country. Large quantities of plate were then melted up to enable the nation to carry on her war with England, and a great portion of what then escaped the crucible went towards the payment of the heavy ransoms demanded for the chiefs taken in battle.

Concerning silver work in England during these centuries, but scant information can be obtained, and specimens still left to us are even more rare than in the neighbouring country.

This period had a dark commencement, under the auspices of King John. His son, Henry III., was a great admirer of the arts, and did much towards the development of artistic workmanship in the precious metals. The greatest work undertaken during the reign of this King was the Abbey of Westminster. One object destined for this edifice—the shrine of Edward the Confessor—claimed his especial care, and, from documents, we learn what riches were expended upon the ornamentation of this costly gift. The shrine was commenced under the superintendence of Odo, but was not quite completed at the time of the King's death. William of Gloucester was also employed by Henry, the silver statue for the tomb of the Princess Catherine being by his hand. St. Paul's Cathedral was also very rich in works of silver. From the inventory of the objects in this cathedral, we learn that the service of the Church must have been here performed with great magnificence.

It was during the reign of Edward I., that a great part of France was under the sway of England. In the conquered district was Limoges, which accounts for the large quantity of enamelled works that were now introduced into England, and it would seem were greatly admired by the English, for the art was soon after largely practised in this country.

(*To be continued.*)

"FLASHING" IN ASSAYS OF GOLD,

AND ON THE

INFLUENCE OF THE METALS OF THE PLATINUM GROUP ON IT.

WHEN 500 milligrms. of pure gold with 1 to 2 grms. of lead, or when 500 m.grms of pure gold, 50 m.grms. of copper, with 4·5 to 5 grms. of copper, with 4·5 5 grms. of lead are cupelled at a temperature exceeding the melting-point of gold, and after the operation the liquid metal is withdrawn from the muffle, a comparatively long time will elapse,—thirty or forty seconds,—before the button sets. The cupelled gold, which is incandescent on leaving the muffle, cools below redness without changing its state. Suddenly the button emits a *brilliant clear greenish light.* This phenomenon is termed "flashing," (*l'éclair*), and the brilliancy of the glowing button diminishes while the metal cools, and ceases entirely when it sets.

"Flashing" is always produced in a very distinct manner when 250 m.grms. of gold, 25 m.grs. of copper (the copper is essential), 626 m.grs. of silver are expelled with 3 to 3·5 grms. of lead (this being the ordinary composition of "check" assays weighing 0·25 grm. for the standard 900), or double this when half a gramme of metal is taken for assay.

In order to obtain good results it is necessary that the following conditions be observed:—

1. The cupellation must be concluded at least at the temperature of molten silver.
2. The alloy of gold and silver must be liquid at the moment of withdrawal from the muffle.
3. The liquid globule must present a polished surface, and there must be no indication of internal or superficial movements.
4. In removing the cupel containing the button from the muffle, care must be taken to avoid the least shock or rough movement.
5. Cooling must be effected in a uniform manner.

When these conditions are duly observed, the metal, which is heated above its melting-point and luminous at the moment of removal from the muffle, cools sensibly below this temperature while remaining in the liquid state. It cools below redness, ceases to be luminous, and then suddenly "flashes."

This development of intense heat again raises the metal to its melting-point (about clear cherry redness), and only then does it begin to solidify while gradually losing its latent heat of fusion.

I believe that the "flashing" may be perfectly explained by the *superfusion* to which gold and its alloy with copper or with silver and copper are subjected, when expelled at a high temperature with lead in excess. There is a limit of temperature below which the fluid metal cannot cool without suddenly *parting with all its latent heat of fusion*, and this re-heats the cooled globule to its true melting-point, which in the case of gold and the alloy with silver, is above 1000° C. But it is an admitted fact that solid or liquid bodies so raised to a high degree of heat often emit a peculiarly intense light, and this light is known in the experiments before us as the "flashing" which precedes the solidification of cupelled gold.

On cupelling gold with excess of lead, together with eleven-thousandths of magnesium, a liquid button incrusted with a mixture of oxides of lead and magnesiun was obtained. Notwithstanding the abnormal layer on its surface, the solidification of the metal was retarded, and it "flashed" very distinctly. With aluminium, zinc, cadmium, iron, nickel, tin, and antimony added to the pure gold in quantities not exceeding 12·5 thousandths, the flashings invariably took place, the buttons of cupelled gold presenting under these conditions the ordinary brilliant yellow surface.

According to the experiments of Dufay in 1727, confirmed later by Chaudet, lead may be replaced in cupellation by bismuth. Pure gold cupelled with excess of bismuth "flashed" with great intensity. Copper promotes the superfusion of gold. When 500 m.grms. of gold and 500 m.grms. of copper are cupelled with 5 to 6 grms. of lead, the button remains liquid during 45 to 50 seconds before "flashing," while gold cupelled without the addition of copper sets in 30 to 35 seconds after the actual withdrawal of the cupel from the muffle.

Pure *silver interferes* with the phenomenon of flashing as soon as it is alloyed with gold in the proportion of 375 thousandths and upwards.

I explain this fact by the well-known property possessed by *molten silver* of *absorbing oxygen*, which is evolved when the metal solidifies, giving rise to to the effect known as "springing." This destroys the internal quiescence of the liquid mass that is essential to its maintenance in the superfused state.

This *resistance* of silver to the phenomenon of "flashing" may be *overcome* by its addition to its alloy with gold of a certain quantity of copper. When 625 m.grms. of silver are cupelled with 250 m.grms. of gold and 25 m.grms. of copper and 3 grms. of lead, and the cupel is removed from the muffle at the moment when the button clears and shines brightly, the cupelled alloy remains for an abnormal length of time in the liquid state, down to a temperature well below the ordinary melting-point of the alloy in question. A sudden light terminates this state of superfusion and the button sets, presenting an even dead white surface with a slight depression at its centre. If, instead of waiting for the limiting temperature to be reached, momentary contact is made with a small portion of solid silver, the superfused state is abruptly disturbed, the metal "flashes," and then solidifies.

Palladium and platinum, the only metals of the platinum group that are malleable, ductile, and soluble in *aqua regia*, do *not hinder* the superfusion and flashing of cupelled gold. I have added as much as 12·5 thousandths of palladium, and even 22 thousandths of platinum to pure gold, or cupriferous gold (and its alloy with silver), without preventing flashing, which occurred in fact with much intensity.

But the case is very different when it becomes a question of adding other metals of the same group. It is only necessary to add an infinitesimal portion of one or more of these metals before cupellation with excess of lead to produce an *alloy*, which, when removed from the muffle in the molten state, *solidifies*, almost directly, in the ordinary way *without flashing*, superfusion having been prevented. With cupriferous gold, or with an ordinary assay of 900 standard to which some traces of iridium, rhodium, ruthenium, osmium, or osmium-iridium have been added, the same results are obtained; that is to say, there is normal and rapid solidification, absence of flashing, and the production (in the ordinary assay) of a *solid button* with a surface which is brilliant but irregular and rough.

The quantities I employed varied as follows:—

Iridium	from	0·30	to	25.5	thousandths
Rhodium	,,	0·16	to	12·0	,,
Ruthenium	,,	0·27	to	12·75	,,
Osmium	,,	0·42	to	12·0	,,
Osmium-iridium	,,	0·50	to	4·5	,,

The explanation of the absence of flashing in all these experiments may be found, I believe, in the following fact:—Gold and silver alloy perfectly with platinum and palladium. In conclusion, I would draw attention to this novel mode of investigating the causes of the non-malleability that is at times observable in the preparation of gold for coinage. The alloyed metal, although it may have shown no signs of *fracture* in passing through the ordinary rolls, is occasionally found to *crack irregularly* in traversing the *draw-bench*. I believe this to arise from the presence of streaks of iridium, osmium-iridium, etc., which destroy the continuity of the metal, rendering it locally brittle. The *absence* of "flashing," when such a good alloy is cupelled with lead, will afford exidence of this being the case.—DR. A. D. VAN RIEMSDIJK, Assayer-General of the Netherlands Mint, Utrecht.—Translated from the Dutch, for the *Chemical News*, by W. CHANDLER ROBERTS, F.R.S.

SUBSTITUTE FOR GOLD BRONZE.—According to the experiments of Dr. B. W. Gerland, metavanadic acid may be used in the preparation of a substitute for genuine gold bronze. If a solution of sulphate of copper and salammoniac is mixed with vanadiate of ammonia and cautiously heated, there is obtained a compound of a splendid gold colour, which is deposited from the liquid in the form of gold-coloured spangles. These admit of being readily ground up with gum and varnishes, cover well, do not change on exposure to air, and are in every respect equal to genuine gold bronze. Vanadium yields also a series of very fine colours, especially adapted for painting on porcelain.

ALUMINIUM.—It has become somewhat common in Paris to make the frames of opera glasses and telescopes of aluminium. But the most favourable use apparent for this curious metal, by reason of its low specific gravity, is the making of beams for balances; aluminium bronze beams have been made for several years past, but, as far as lightness is concerned, they have scarcely any advantage over brass. Several reasons are given for the small amount of favour with which aluminium is regarded by mathematical instrument makers. First of all, there is the consideration of price; then the methods of working it are not everywhere understood; and, further, no one knows how to cast it. Molten aluminium attacks the common earthen crucible, produces silicon from it, and becomes grey and brittle. This inconvenience, however, has been overcome by the use of lime cruicibles, or by lining the earthy crucible with carbon or strongly burnt cryolith. It is thought that, were the casting of aluminium to become an industrial operation, the metal would be more freely used in the finer branches of practical mechanics. At present the production and use are almost exclusively confined to French metallurgists.

THE
WATCHMAKER
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JOURNAL.
W H TILBY

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

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CONTENTS.

	PAGE
The Time Work and Time Signals of the Greenwich Royal Observatory	23
Practical Instructions to Jewellers, Silversmiths and Electro-platers	25
The Silver Trade	26
Art Work in the Precious Metals	27
Hints to Repairers	28
The Manufacture of Jewellery in Providence, Rhode Island	28
False Turquoise	29
An Important Horological Invention ..	29
A Few Words on Gems and Precious Stones	30
The Construction of a Simple but Mechanically Perfect Watch	31
The Permanent Exhibition of Watches, Clocks, Musical Boxes, and Jewellery at Geneva	32
The Goldsmiths' Company..	33
Sapphire Mines of Siam	34
Patents	i
A New Jewel Stand	i
Monthly Record of Bankruptcies	ii
Book Notice	ii
Directory	iv
Advertisements	..i—xii

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THE TIME WORK AND TIME SIGNALS OF THE GREENWICH ROYAL OBSERVATORY.

By C. Stuart Murray.

(*Continued from page* 12.)

In order to arrive at what is called mean time, the astronomer has to deal with a sidereal day and a solar day. There is a lunar day, which indicates the interval of the moon's meridional passage from one day to the next; the time of this day always exceeds twenty-four mean time hours, varying from 24 hours, 40 minutes, to 25 hours 6 minutes. On account of this large irregularity, astronomers never employ the moon as a time measurer in the same way that they do the sun and stars.

A sidereal day is the transit of a star over the same meridian twice; in other words, such a day is the interval between the first appearance of a star on the meridian of Greenwich and its next appearance on the same point.

There is a belt of constellations near a great circle of the heavens called the ecliptic, or path of the earth round the sun, known as the zodiac, from a Greek word signifying an animal, because those constellations were supposed by the ancients to resemble animals of some kind with one exception, namely, *Libra,* the balance. There is a ram, a bull, twins, a crab, a lion, a virgin, a scorpion, an archer, a goat, a water carrier, and two fishes. These constellations are made up of groups of stars, and the first point or star of Aries, the ram, is what the sidereal day is measured by. When this point passes the meridian of Greenwich *twice,* a sidereal day has been completed. This sidereal day is a little shorter than a mean time one, and consists of 23 hours, 56 minutes, and 4 seconds of mean solar time. The sidereal day has a sidereal clock, and if this clock is regulated it will always show meridian time when the star does; the appearance of the latter on the meridian does not vary one second of time from one day to another—in fact, from one century to another. If the earth did not move in an orbit round the sun we are told that the sidereal day would be the most exact time that could possibly be made; but as a sidereal day is nearly four minutes shorter than a mean solar one, on this account it will not answer our purpose entirely.

The solar, or *apparent* day, is the passage of the sun twice across the same meridian, and is the time that is shown upon a correct sun-dial. But as the sun increases and declines throughout the year it will not do for a measure of time. The sun's days are not equal, as we all know. As neither the sun-dial day nor the sidereal day will give the time that is wanted, recourse is had to computation, and by means of this computation we produce what is known as "mean time," or a mean solar day throughout the year. This day contains 24 hours 3 minutes and a decimal over 56½ seconds of sidereal time, thereby making it longer a little than a sidereal one. In order to have a reliable basis, the whole of the solar noons in a year have been taken, and an average mean of all these has been calculated, the duration of one of the said days giving what is known as "mean time," and the difference between this and the sun-dial is called the equation of time. It follows, therefore, that the astronomers do not go by the real sun of the heavens, but by an imaginary one that they are able to fix on the same meridian at the same instant every day throughout the year, no matter what part of its path round the sun the earth may be in. As this mean time day has a mean time clock that beats so many seconds in the twenty-four hours, it can always be regulated by means of the real sun, the sidereal clock, and the transit instrument. From this combination arises what is known as "the equation of time," or the difference between true solar time and mean time. The difference is so great that in November the true sun-dial time is a quarter of an hour before mean time, and in February a quarter of an hour behind it. A table will be found in most almanacs called "clock before sun" and "clock after sun."

There are three causes all acting in combination, which go to vary the length of the solar days. These are the inequality of the diurnal motion, the difference in the direction of that motion, and the greater or less angular distance from the equator at which the motion is effected. It would be too much extending this paper were we to go into a full explanation of all these causes; in fact, they would require a paper for themselves. It may be stated that the motion of the equatorial fictitious sun is based upon that of the real sun, and that the hour circles of these respective suns always coincide four times in each year, namely, in April, June, September, and December. Their meridians have been known to be passed almost at the same instant. Astronomers have computed sets of solar tables from which can be seen day by day the relative positions of the true sun and the equatorial fictitious sun; the clock of this fictitious sun has, too, a certain relationship to that of the sidereal clock, and ultimately to what are designated "clock stars," which govern them both, and are the real foundations of our time keeping. They tell us at Greenwich that the real and fictitious suns are never far apart in position, and that the inconvenience of having the mornings sometimes a little longer than the evenings, and at other times the evenings a little longer than the mornings, is as nothing when put against having an equalising standard for time. Curiously enough, and directly contrary to what most people believe, Mr. Criswick told us that in fixed observatories the sun is not made use of for finding mean time "except in cases of rare emergency, owing to the errors still remaining in the solar tables." The "clock stars," as we understand it, whose positions have been settled by the accuracy attached to the continued scientific observations of a hundred years are what the astronomer relies upon. They are called "clock stars" because they are so distant that they always appear to be in the same places in relation to the yearly journey of the earth along the ecliptic around the sun. With respect to this distance and motion, a few words of an explanatory character may be acceptable.

The nearest star to the earth is so much farther off in miles as compared with the sun that it is perfectly useless to write it down in figures; no reader could comprehend them, but this may afford a glimpse of the immensity. Light comes from the sun in 8¼ minutes, whilst from the nearest star it takes three years and four months. Arago, the celebrated French astronomer, has laid it down that the light from the smallest stars visible in the telescope of forty-feet focal length will require 2,700 years to reach the earth! Taking, therefore, the computed rate of the earth through space to be over 65,000 miles an hour, the distance of stars from it that never seem to move may be imagined, but cercertainly not comprehended. The whole length of the earth's orbit has been put down at nearly 574 millions of miles, and as the "clock stars" never seem to us to change their position towards us, whatever part of that orbit we may be in, the non-astronomic mind becomes dazed with the vastness of the subject.

Ignorant and thoughtless people babble about *millions* and *billions*, as if such numbers stood for so many eggs in a basket; indeed, at times, with even less consideration, many of them would not know a million or a billion in figures if they saw the figures. Well, here they are respectively—1,000,000 and 1,000,000,000,000. The Christian era had a beginning, but at the very first second of time of the year 1 until this present moment not one-sixteenth of a billion of such seconds has passed! There are 86,400 seconds of time in twenty-four hours, or a day; it would therefore, by computation, require just 31,687 years, 17 days, 22 hours, 45 minutes, and 5 seconds to make up a *billion* of seconds of time.

The real time makers at Greenwich are the transit instrument and the standard sidereal clock. The "transit" is a telescope twelve feet long having an object-glass of eight inches. The tube is made of cast-iron, braced and strengthened as far as practicable, is conical in the centre and rests by means of its trunnions upon firmly built solid piers. There is fixed upon one of its trunnion-pivots a finely graduated circle of degrees, minutes, and seconds, with micrometers and vernier to read them off by. The instrument is pivoted due east and west, thereby giving an axis north and south. Near to each end of it is a horizontal line of mercury by which to test the line of sight and ascertain if there are any errors—errors of collimation, as they are called. In the taking of observations, the moment that the clock star is on each wire the observer touches a telegraphic key, which is on the tube of the telescope near the eye-piece. That touch causes a mark to be made upon the chronograph in another room, which mark is entered in the transit-book when convenient. And now let us look at the chronograph. This instrument is a kind of timekeeper itself, and consists of a brass cylinder twenty inches long and twelve inches in diameter. It has a train of wheelwork, driven by a clock-barrel weight, and regulated by a conical pendulum, the lower or bob end of the pendulum terminating in a kind of paddle-float, and revolving in a flat basin filled with glycerine. The resistance of the glycerine to the motion of the paddle-float performs the same functions as the ordinary pendulum bob. The chronograph cylinder revolves once in two minutes, and it is covered by a sheet of paper ruled in faint lines by itself. There are arrangements of magnets and prickers, by which, when the observer touches the key at the transit instrument, a steel point pricks the paper. As the sidereal standard clock, by means of one of its wires, also makes punctures in the paper every second, the observer can tell upon examining these marks and the spaces between them on the revolving cylinder at what particular fraction of a second each wire in the object-glass of the transit instrument was crossed by the clock star. Six hours' observation work can be put upon each paper cylinder, and four observers can mark at the same time, provided that no two of them touch the telescope key of their several instruments at the same electric moment, a very unlikely occurrence indeed.

The first time signal is sent out from Greenwich at ten o'clock every morning, but before that can be done three separate branches of the subject have to be dealt with.

(*To be continued.*)

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. XVII.

(*Continued from page* 13.)

To Tin Zinc.—The proportions of the bath are as follows :—

Distilled water, 66 gallons;
Pyrophosphate of soda, 11 pounds ;
Fused protochloride of tin, 35 ounces.

A thin tinning is obtained by simple dipping, and one of any thickness by the aid of the battery.

Whitening by Tin.—The tinning process described in the last number must not be mistaken for the process called *whitening by tin*, which has been practised from time immemorial by manufacturers of pins and other small articles. It is effected by boiling for two or three hours in long copper troughs, crude cream of tartar with tin plates supporting a layer of about half an inch of the pins, or other small articles, to be whitened. The whole charge is composed of alternate layers of pins and tin plates, so that each layer of pins is between two tin plates. This process will not succeed with iron unless an intermediate coat of copper has been deposited. Deposits of tin obtained in this manner will not preserve iron from oxydation.

Gilding.—This is done by two distinct methods; by the *wet* and by the *dry* process. Gilding by the wet process is effected either by single affinity or chemical reactions called gilding by dipping; or then by chemical and electric reactions combined, and known as *electro-gilding*.

Gilding by Dipping.—This method is applicable to the small articles which make up imitation jewellery, and is principally employed on copper or such alloys as contain a large percentage of that metal. The baths employed contain gold in the form of a double salt of protoxide. A solution to be fit for this kind of gilding should possess the following indispensable properties :—

It should have little stability, that is, it must decompose readily and abandon its gold under feeble influences. It should dissolve the copper immersed in an equivalent proportion to that of the gold deposited, thus forming a new double salt in which the copper is in the same degree of oxidisation as the gold. When the articles have been previously amalgamated, as is generally the case, it is mercury and not copper which is substituted for gold in the solution.

Preparation of the Gold Bath:—

Distilled water, 17 pints ;
Pyrophosphate of potash, or soda, 28 ounces ;
Hydrocyanic acid of $\frac{1}{8}$ prussic acid, $\frac{1}{3}$ of an ounce;
Crystallised perchloride of gold, $\frac{2}{3}$ of an ounce ;

The pyrophosphate of soda is most generally employed, and is obtained by melting, at a white heat, the ordinary crystallised phosphate of soda. The pyrophosphate of soda may be obtained in the form of crystals, which is a proof of a definite composition. The quantity of chloride represents a little more than $\frac{1}{3}$ of an ounce of pure gold treated by aqua regia. Put 16 pints of distilled water in a porcelain vessel, or an enamelled cast iron kettle, and add, by small portions at a time, and stirring with a glass rod, the pyrophosphate ; heat, filter, and let it cool down. The chloride of gold is prepared by introducing into a small glass flask :—

Pure gold, finely laminated, $\frac{1}{3}$ of an ounce ;
Hydrochloric acid, pure, nearly 1 ounce ;
Nitric acid, pure, $\frac{1}{2}$ an ounce.

The flask is slightly heated, effervescence and abundant nitrous vapours result, and in a few minutes the gold has entirely disappeared, leaving a reddish yellow liquor. The flask is then put upon a sheet of iron, with a hole in its centre, and supported by a tripod. The whole is heated by a gas or spirit lamp to evaporate excess of the acids ; too much acidity may cause great irregularities in the working of the bath, and even prevent its action altogether. An excess of nitric acid causes a jumping of the heated liquors, and may overthrow the whole; it is preferable to have the hydrochloric acid predominating. The evaporation is finished when vapours escape slowly from the flask, and when the liquid has become of an oily consistency and of a deep red colour. The flask is then removed from the fire by wooden pincers and set to cool upon a ring of plaited straw. If a more rapid evaporation is desired, heat the flask over ignited charcoal or the spirit lamp ; agitate the liquid to prevent any of the gold from returning to the metallic state. Well-prepared chloride of gold when cold forms a saffron-yellow crystalline mass. If the colour is red, it has been too much evaporated, and will do very well for electro baths; but for dipping baths it must be heated again after a small addition of the two acids. If the perchloride of gold by too protracted a heat has passed to the state of insoluble protochloride, or even of metallic gold, the treatment must be begun again with the indicated mixture of pure nitric and hydrochloric acids. The perforated sheet of iron upon which the flask rests is intended to prevent the action of heat upon the sides of the vessel, which will decompose the films of chloride of gold wetting the flask at these places. When the chloride of gold is cold and crystallised, dissolve it in the flask with a little distilled water, and pour the solution through a paper filter held in a glass funnel into a clean bottle ; this is to separate a small quantity of silver always found in the gold of the trade. Rinse the flask and filter with the unemployed water so as to get all the gold into the bath. Pour the filtered solution of chloride of gold into the cooled one of pyrophosphate and stir with a glass rod. Lastly, add the hydrocyanic acid, and the bath is heated nearly to the boiling point for use. If the solution of pyrophosphate is still tepid, add the hydrocyanic acid before the chloride of gold. Hydrocyanic or prussic acid is not absolutely necessary ; but without it the bath is too easily decomposed, and the gold is too rapidly precipitated upon the objects placed in it. When the solutions are mixed in the cold, the liquor is yellow or greenish yellow, but becomes colourless by the increase of temperature. If the liquor becomes currant red, or wine-lees violet, it is an indication that there is too little hydrocyanic acid ; add it drop by drop, until the liquor becomes colourless. An excess of this acid is objectionable, but there is a very simple method of keeping the baths in good working order, by adding prussic acid to those too rich in gold ; or correcting any excess of prussic acid with a small proportion of chloride of gold until the gilding is produced without difficulty and of the proper shade. Thus prepared, the bath will produce very fine gilding upon well-cleansed articles, which must also have passed through a very diluted solution of nitrate of binoxide of mercury, without which the deposit of gold is red and irregular, and will not cover the soldered portions. The articles are supported by a hook or in a stoneware ladle perforated with holes, or in brass gauze baskets ; they must be constantly agitated whilst in the bath.

(To be continued.)

Spinel Crystals.—M. Meunier claims, in *Comptes Rendus*, to have produced spinel crystals, and thinks he has also produced periclase and corundum by the action of steam on aluminium chloride, at a red heat, in presence of magnesium.

THE SILVER TRADE.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

MR. EDITOR,—In the House of Commons' Committee on Hall-marking, the question No. 1,468, put by Sir Charles Russell, one of the members for Westminster, to Mr. Thomas, the eminent silversmith of New Bond Street, was at once pointed and pertinent. It was this:—"What I want to ask you as a practical vendor of old plate yourself is, how is it that gentlemen who are collectors are constantly finding that they have got plate with what they considered the right marks upon it, but which are proved by experts afterwards to be fraudulent?" Mr. Thomas answered—"I have not known so many cases of that; there may exist fraudulent hall-marks, but I do not think there are many; there may be cases of the transposition of marks which may be more common, but I do not think there are many forged hall-marks; I do not think it is carried on to any extent; I believe there are some, but not to any large extent." This answer throws little light on the subject, but since that time events have happened which may, if properly investigated and made public, furnish an answer to Sir C. Russell's question of a very enlightening and suggestive kind. What has yet been made known has only been enough to sharpen our appetite for further information.

It appears that a rich patron paid a great price for between six and seven hundred pieces of silver plate to a London silversmith in a large way of business, under the impression that they were all made and marked in the reign of Queen Anne. This occurred in 1872-3; but last autumn this plate was seen by one well acquainted with hall-marks and was at once declared by him to be spurious. On application being made to the seller, who is said to be able to pay a fine of £6,000 without difficulty, he shifted the responsibility on to a silversmith in a small way of business, who, we are informed on the same authority, would have some difficulty in paying a fine of even £100, bnt who yet seems able to find very efficient legal advice in his hour of trouble.

This transaction is likely to suggest various reflections to different people; for instance, How have the shopkeeper in a large way and the manufacturer in a small way of business employed themselves in the interval between the fraudulent transaction and its discovery? and, What means do the Goldsmiths' Company use for the prevention and discovery of frauds of this kind?

In the report of the Commons' Committee we find Mr. Puleston remarking to Mr. Prideaux, in question No. 1594,—"You state that whenever information is sent you, you prosecute, or make such an investigation as to lead you to prosecute; do you take any steps, and if so what, to get information, so that offenders may be indicted and punished?" Answer.—"*We wait until it is brought to us.* We think that the trade ought to be as much interested in their affairs as the Goldsmiths' Company, and that it is their duty and interest to bring us information of cases of malversation in which they require us to act; it would be a very invidious thing for us to employ detectives to go over the town to detect evasions of the Act." No. 1,599.—"You seem to get at it rather accidentally than otherwise?" Answer.—"There is the trade, and here we are existing for the protection of the trade, and if the trade do not come and give us information of these cases it is they who are to blame; *we certainly have done all we can do.*" The whole arrangement illustrates the homely proverb that "What is everybody's business is nobody's business," and leads by the most natural steps to Sir P. O'Brien's remark in No. 1614, that "he thinks the trade are not the sole persons to be regarded in the inquiry, and that there are people called the public." He asks "whether they rely solely on the trade for information?" Answer.—"I do not say solely on the trade, because in a great number of cases the information comes to us from discharged workmen." It is surely rather a nice casuistry that looks upon it as invidious to employ detectives, and yet is ready to receive information from workmen who may have fallen out with their unscrupulous employers. But the impression left by the whole of this evidence is, that the Goldsmiths' Company undertake a duty for the protection of the public which they cannot efficiently perform, owing to the inadequacy of the means used by them for the purpose desired.

Among the oldest and the most formidable of the powers granted to the Guild of Goldsmiths was that of searching for and breaking up, or forfeiting to the use of the Crown, all wares made of less than standard quality, and there is proof in the old records of the company how troublesome and even dangerous the duty sometimes was. At that time London, probably, did not cover a greater space or contain a greater number of inhabitants than some of the second-rate provincial towns of the present day. If, then, at a time when the company habitually used their right of search there was so great a difficulty in keeping the public from being cheated by dishonest dealings in gold and silver wares, how much more difficult must it be in the present day when London about covers the area of a county, and is inhabited by a concentrated nation. Nothing short of a fully organised and carefully supervised excise could cope with the difficulty, and it is quite unlikely that an institution of that kind will ever be founded again among us for a purpose of that nature. Except in rare instances, the action of the company is confined to verifying the quality of the wares sent to be assayed, but they take no voluntary steps whatever to learn whether the allegations so confidently made by writers so respectable as Mr. Cripps and the author of the article in the *Quarterly Review* that there is daily exposed for sale in the shops of London a large quantity of fraudulently marked plate are true. Giving the company full credit for the desire to safeguard the public against fraud, it is too apparent that the task is beyond their powers, hence the impunity with which a shopkeeper in a large way of business, employing a manufacturer in a small way, has been able to carry on and flourish for a number of years; and it even now appears, when the facts have been ascertained beyond doubt or cavil, that the meshes of the law have been so imperfectly drawn that both the large and the small delinquent will make their way successfully through them.

In the face of facts like these it is unlikely that even the most conservative of the Company's officials can feel at ease over the wide discrepancy between what the general public give them credit for doing and the reality, and they cannot but feel that changes of a very sweeping character in the conditions under which the silver trade is carried on are for this and other equally cogent reasons matters of absolute necessity if it is ever again to be raised from its present lamentable condition.

As a helpforward to the discussion on hall-marking, nothing better has appeared than the letter of Mr. John Jones, of 338, Strand, in the *Citizen* of August 21st, in which he shows that tradesmen who have established their reputation as competent and honest dealers may dispense with the troublesome process of hall-marking. The great American manufacturing firms such as the Gorham Company and Tiffany do all their enormous business without hall-marking, and with a system of voluntary hall-marking our own leading houses could no doubt do the same; their name and a stamp declaring the quality of the silver would serve every purpose the public could desire. It may even be suggested that anyone who will adopt and rigidly adhere to the practice of making and advertising his silver goods as a pennyweight better than the legal standard would soon establish as great and durable a reputation as the great Sheffield cutlery houses, who are now reaping the benefit of their wise policy in using the best material and workmanship, by the great demand that has again sprung up for their goods in the American market.

Great changes are pending in the City, and the *Citizen* of August 21st has done admirable service by republishing the speech made by Mr. Gladstone some years ago on being made a member of the Turners' Company, which proves that the ancient guilds have no truer or wiser friend, nor one who is more desirous of seeing them restored to that position of dignified usefulness from which in the lapse of time, and by reason of changes in our habits and modes of conducting affairs, they have undoubtedly fallen away. What, for instance, can be less like than the Goldsmiths' Company as originally constituted and its present condition? It is surely odd to find that nothing can be more rare than the presence of any gentleman on the court of the Company who has a practical acquaintance with the goldsmith's art, yet the last elections of that description were those of Mr. J. Brogden in 1824, and Mr. J. H. Watherston in 1850. This might not matter in those Companies which have long since severed connection with the trades whose names they still bear. But it cannot be doubted that had the gold trade been better represented at the court in 1861 the law would never have been enacted enabling gold of the low qualities of 15, 12, and 9 carats to be hall-marked, an arrangement which the Committee of the Commons recommended should be repealed in their report to Parliament.

Practical silversmiths have not been much better represented, but a better prospect seems to open up in that direction by the election of so eminent a manufacturer as Mr. Stephen Smith, and of Mr. George Lambert, so close to each other, that they will be called upon to fill wardens' chairs together in 1884-5; by that time the new Technical Institute at Kensington will probably be finished and in working order, and it is to be hoped that their ripe experience in the trade may be utilised in arranging the studies to be followed in that institution.

Mr. Gladstone points to the great good being done for the country by the reformed Universities, and looks forward to a like result from the coming reform of the City Companies. At present in their meetings the favourite theme for self-gratulation is their hospitality; but the wisdom even of that as at present understood is being called in question. Dr. Richardson, that modern medical Luther, was invited to bear his testimony against the indulgences of the dining-table even in that high place of good living the Mansion House itself, and advocated reforms with a cogency of reasoning which will be difficult to get over. Be that as it may, the Companies have by their movement in the founding of the Technical Institute opened up the prospect of a new life of usefulness for themselves. A commission presided over by so wise and dispassionate a statesman as Lord Derby, who is himself an honourable member of the Goldsmiths' Company, is little likely to advise alterations of a revolutionary or destructive character, but rather to suggest and point out by what means a new and vigorous life of usefulness may be begun by them, to their great honour and to the profit of many. The eulogy passed by Mr. Gladstone on the Doulton ware and its makers should be read by those who doubt the ability of English people to begin and carry forward an ornamental industry of great originality and high quality without outside aid. Would that some of the same spirit could be infused into our silver trade, which at present seems content to remain in the Micawber attitude, waiting for something to turn up. That something may be done to rouse them up is the not unselfish wish of

Sheffield, 26th August, 1880. An Old Hand.

ART WORK IN THE PRECIOUS METALS.

(*Continued from page* 156, *Vol.* V.)

INCRUSTATION.

THIS process gives almost the same effect as damascene, but incrustation can be employed where it is not possible to use the latter mode of decoration. For example, it is impossible to execute damascene work upon any receding form, or concave moulding; but one is able in these positions to produce incrustation, as the manner of its execution is different, and it is only necessary to make the preparation upon that portion of the ground which is to hold the ornament, so the rest of the surface need not be disturbed. With damascene there is not this advantage, as in that process the whole of the ground undergoes preparation. With incrustation there is another advantage, as this work can be engraved or chased. This cannot be done with damascened work, as from its mode of application it is not sufficiently strong to permit of it.

Preparation.

The external lines of the ornament are engraved upon the iron or steel, and diagonal lines are cut (the same as in the damascene preparation) between these outside lines, that is upon the part only which will form the ground of the ornament; this is done with a small, very sharp flat chisel. If the ornament is to be in high relief, the lines are cut deeply, so as to give it a firmer hold; if it is to be raised but little above the surface, the lines are only engraved lightly. The ornament is now formed with wires, the size used being according to the relief required. Each piece is fixed into the prepared ground, one close to the other—this is done with a tool called a "mattoir"—while following the lines of the design this tool is gently tapped with a small flat hammer. The work is then burnished with a half-round burnisher, in order to bring the separate wires closely together and form them into a solid piece. The outer lines can now be made perfectly even and regular with an engraving tool. Now, also, the ornament can, if wished, be further enriched with chasing. To complete the process, the work is made grey or blue, as described in the article upon damascene work.

Another process of incrustation is that practised by the Japanese. Bronze is usually the metal used by these people into which to incrust the ornament, which is in either gold, silver, or copper. The ornament is cut out by means of a stamp, and is fixed into the ground, which has been cut to receive it, by small strips of metals, which are soldered on at right angles so as to hold it firmly in its place. If the design is in silver or gold, these strips are generally of bronze.

There is yet another process practised by these ingenious workmen, and by it, incrustation in relief, is produced in a way that does not need so much labour as would be required of a European to produce the same effect. A matrix is made by which to stamp in silver or gold the required design, which after being stamped from the sheet, is cut round the edge, so as to form a detached design in relief. Then with the same matrix the ground is prepared to receive the design; the ornament being fixed in its place in the same way as before described. Any irregularity of outline can be removed with an engraving tool. It should be mentioned that before the incrustation is executed, the bronze, which as a rule forms the ground for all such work in Eastern countries, must be oxidised. If the ornamentation is to be gilt, the ground is covered with a composition so that it may preserve its original colour during this process, this is afterwards removed by turpentine, and the work is then washed in hot water with soap.

HINTS TO REPAIRERS.

(*Continued from page* 18.)

THERE is probably no class of clocks used for the ordinary purposes of life that are capable of giving better satisfaction to the public, or less trouble to the dealer and repairer, than those known by the name of French clocks. Their comparative moderate cost, when real worth is taken into consideration, and the beautifully artistic design of the cases, have been the means of creating a demand for them in refined communities all over the globe. Works of art in this line, which were at one time only to be found in the palaces and castles of kings and noblemen, have found their way into the dwellings of those possessed of less affluence, and in various grades of quality they are gradually being introduced into the homes of all possessed of a cultivated taste and a moderate income.

The cleaning and management of these clocks, although simple, and requiring care and a little experience more than any other qualification, is seldom done in a manner that gives full justice to the clock; and it is our object in the present paper to impart a few hints to those who may not have had the necessary experience; and we will begin by making a few remarks on new, or newly imported, clocks.

It occasionally occurs in newly imported French clocks that a movement has been fitted to a case that is not high enough to allow the pendulum to swing free when the clock is regulated to the proper time. Sometimes filing a little off the bevelled edge of the ball will allow the pendulum to clear the bottom of the case or stand of the clock, and allow it to be brought to time. Should any more than just a little taken off the edge of the ball be required, there is no use troubling with it further. You must either get a new movement, or alter the train, or make a new pendulum ball of a peculiar shape. The train is easiest altered by putting in a new scape-wheel pinion containing one leaf less than the old one. In all large cities where pinion wire can be had putting in a new pinion is not much trouble to the practical workman; but if this cannot be done, and a new movement cannot be had, a new pendulum ball of an oblong shape may be used. The application of an angular pendulum will also remedy this defect. This pendulum is formed of two pieces or legs, like a sector, and suspended by an angular point. The time of vibration depends on the length of the legs, and on the angle contained between them conjointly—the duration of the time of vibration increasing with the angle; consequently a pendulum of this construction may be made to oscillate in any given time. At the lower extremity of each leg of the pendulum is a ball or bob, as usual; and if it vibrate half seconds when its legs are closed, it will vibrate whole seconds when the legs are opened, so as to contain an angle equal to 151° 2′ 30″. It is, however, not desirable to apply this pendulum where accuracy is required, as it is difficult to compensate and has a tendency to swing in an elliptical plane.

After unpacking the clocks, whether they are apparently in good condition or not, it is always well to take the movements to pieces, and to examine every action. You may begin by taking off the hands and the dial, first trying if the hands move freely, then examine the drops of the escapement to see if they are equal, and if they are not exactly equal, they can easily be corrected by moving the front bush of the pallet arbor with the screw driver, making a light mark across the bush with a sharp point, which will show how much the bush has been moved. The fly pitching may next be examined, and adjusted by a movable bush in the same way. The object of this bush being left movable is to admit of the depth to be set so that the fly will make the least noise possible, and also to regulate the speed of the striking train. The dial work and the repeating work may now be removed, the *springs let down*, the end and side shakes of the pivots in their holes carefully tried, and all the depths examined; but as a general rule they will be found to be correct. The pivots will, in some instances, be a little rough, and it will not be much trouble for a watchmaker to smooth them a little. After examining the main-springs, and noticing that the arbers are free in the barrels, the clock may be cleaned out and put together; this will be most conveniently done by placing all the wheels first on the back plate, putting the front one on the top. Get all the long pivots into their holes first, and as soon as possible put a pin into the bottom pillars. The locking of these clocks is very simple, and all the pieces that need marking are marked. All the workman has to do is to follow the marks and he cannot go wrong, but should he begin to bend or twist anything he will soon find himself in serious trouble.

(*To be continued.*)

THE MANUFACTURE OF JEWELLERY IN PROVIDENCE, RHODE ISLAND.

BY H. BUSH, Hull.

PROVIDENCE, one of the capitals of Rhode Island, is a finely-built and important manufacturing place, situated on the Providence River, near Narraganset Bay, forty-three miles S.S.W. of Boston, and one of the great centres of the American jewellery manufactures. Soon after the declaration of the Independence of the United States the manufacture of silver ware was begun in a small way at that place, and among the first who embarked in the enterprise were Sanders Pittman, Cyrill Dodge, Ezekiel Burr, Nehemia Dedge, and John Jenks. In 1790, according to the collected statistics of the Providence Industrial Institute, there were manufactured in that city 100 pairs of silver buckles, 1,400 pairs of plated buckles, and 80 dozen silver spoons of different sizes. In 1805, jewellery to the value of 40,000 dols. was produced by thirty men employed in its manufacture. In 1810 the annual product was valued at 125,000 dols., and the number of hands employed increased to about 100. In 1815 the production was estimated at 350,000 dols., by a staff of 175 men. In 1820 the annual manufacture advanced to 600,000 dols., and the staff of workmen increased in proportion. From that time the industry gradually and steadily progressed until 1857, when the number of persons employed were reckoned at 1,700, whose annual wages amounted to 900,000 dols., making up jewellery to the value of 3,000,000 dols. The panic which occurred in that year retarded the progress of the trade for this and the following year, reducing the number of hands employed to 300, but again revived in 1859, and has ever since steadily prospered, counting now about 150 separate establishments, employing a capital of over 6,000,000 dols.

The styles and qualities of the goods manufactured since the first introduction of this industry to Providence varied, of course, with the fashions and demands of the times, and have undergone many changes. In 1825, Pittman and Dorrance and George A. Richmond were leading manufacturers in the place, and celebrated for superior filigree work. In 1830 Adam Sackett began to manufacture in partnership with Lloyd Shaw, distinguished for the manufacture of superior plated jewellery, making a profit of 40,000 dols. annually. In 1835 soft solder goods were in great demand; the articles produced in this manner were showy, durable, and cheap, being hollow pressed of thin gold plate and solidly filled with soft solder. Fob chains and seals, watch keys, signet rings, and scarf pins of enormous size for gentlemen's and ear rings, breast pins, colliers, and bracelets for ladies' wear were sold in immense quantities; but these goods were mostly superseded by imitations made of plated metal intead of thin gold plate. At the same period existed also a style of filigree jewellery of most peculiar design. In 1840 a great demand sprung up for diamond jewellery, and as the prices of genuine ornaments of this description prevented many from indulging in the luxury, ingenious imitations were resorted to, and an immense trade therein resulted. Shell cameos, mosaic, and Florentine jewellery succeeded the diamond rage for a few years, along with enamelled jewellery, up to 1855. In 1855 began a marked change in the jewellery trade; many firms which had been making cheap goods commenced the manufacture of goods of a better class and of superior design, while cheap goods were produced still cheaper. From this time dates the division of the trade into the solid gold and plated gold branches. The plating with gold which had previous to that time been done on silver was changed in plating on composition of a variety of alloys. Plated ware consists of two kinds, "rolled plate" and "electro-plate," the former being the superior and possessing the advantage of preserving appearance nearly as long as gold jewellery, and costing less than half the price of the genuine article, whilst the electro-plate is used to produce the bulk of cheap jewellery.

Besides these branches there is a good trade done in the manufacture of tortoiseshell, jet, horn, vulcanite, and celluloid jewellery of great variety. Now and then a rage springs up for either antique, Chinese, or Japanese jewellery, and manufacturers are compelled to imitate or invent designs to satisfy the demand. The manufacturers of gold jewellery make steady progress in art, but plated makers are satisfied with imitating gold patterns. Some splendid designs are produced in alberts, guards, necklets, lockets, seals, studs and solitaires in rolled plate, electro and firegilt, under the designation "Canadian jewellery," and are advantageously introduced in almost all the foreign markets. Steam power and machinery in the manufacture of jewellery were introduced by Sackett, Potter, and Hicks in 1835, and have kept on increasing and improving. Providence also produces a great variety of Masonic, Oddfellow, and society ornaments of elegant design and workmanship. The whole line of ornaments in jewellery from the costliest to the cheapest article is produced in Providence, offering an unlimited range of choice.

FALSE TURQUOISE.

TO THE EDITOR OF THE "TIMES."

Sir,—Some time ago you published a letter of mine calling attention to a series of spurious emeralds that were being offered for sale. Will you permit me now to state, as a caution to the public, that numbers of the false turquoise have during the last two weeks come from Vienna and are still arriving? Their detection is somewhat difficult, the backs of every specimen having been pecked out and the holes filled with a black cement, to imitate the matrix of La Vieille Roche. They are, however, a little lighter than the real turquoise, the specific gravity being 2·4, while that of the genuine stone is 2·6 to 2·8. The easier method of distinguishing them is to use a penknife to the false matrix, which can easily be removed, revealing the artificial perforations.

Most obediently yours,
Bryce-Wright.

New Athenæum Club, Suffolk Street,
Pall Mall, Aug. 11.

AN IMPORTANT HOROLOGICAL INVENTION.

(Communicated by H. Bush, Hull.)

Herr August Ernst Müller, chronometer maker, of Vienna, Austria, has succeeded, after many years' study, experiment, and practice, in constructing a chronometer escapement, patented in the principal European countries and the United States, and at present exhibited at the Elite-Industrial Exposition in Vienna, which promises to be the time indicator of the future. The inventor claims the following advantages:—

1. Watches with this normal chronometer escapement can be produced at the same price as those with lever escapement, and marine chronometers at about one third of present price. It can also be applied to turret clocks at a slight additional outlay.

2. Temperatures, even extreme ones, have no influence on the rate of this escapement.

3. The action of the escapement is absolutely uniform and independent of the motive power and inequalities of the train.

4. The escapement does not require an isochronous balance spring and difficult adjustment.

5. The nearest possible isochronism of the balance is effected, securing a timekeeping of less than a minute's variation in a year, or five seconds in a month, by a simple, peculiar, and unique arrangement, dispensing with compensation balances or auxiliary compensations, and consequently saving the expense arising from their construction and application.

6. The impulse of the escapement acts with a minimum amount of power, and is therefore enabled to operate with a considerably weaker force of mainspring than is the case in other watches, which accelerates the diminution of friction of the acting parts.

7. The escapement once in action will not stop even if exposed to excessive shaking, and a banking will be absolutely impossible. The requisite power for setting it in motion is so light that the winding of the movement will itself produce the oscillations of the balance.

8. The friction of the teeth and pivots being, in consideration of the weak motive power required, very slight, makes this normal chronometer escapement more lasting and durable than any other chronometer escapement.

9. That all the parts of the escapement can be produced by the application of machinery, which is impossible with ordinary chronometers necessarily requiring hand finish by an expert in watch work.

10. That in consideration of the superior timekeeping qualities, small cost of production, and ready application to all timekeepers and turret clocks, the normal chronometer escapement is capable of superseding public clocks set in motion by electricity or pneumatic motors, which are not only of very expensive construction, but at the same time far less reliable and uniform.

The Glashuette School of Horology.—Our German contemporaries tell us that the foundation stone for the new school building was laid on the 9th ult. From the reports we gather that the ceremony was a very impressive one, showing the deep interest which Germany's leading watchmakers take in the institution. We wish the undertaking every success, which may be looked upon as certain so long as it remains in the care of such able and devoted men as Grossmann, Stäckel, and Lindemann.

A FEW WORDS ON GEMS AND PRECIOUS STONES.

By Edward J. Watherston, F.S.S.

(*Continued from page* 16.)

The current of ideas that led to the engraving on precious stones is very clearly sketched out by Camillo Lionardo, an Italian writer of the fifteenth century, himself a firm believer in the power of "charms" and "amulets." Taking up the argument that the ancient Greeks and Romans, following in the footsteps of the Egyptians and Persians, were perfectly reasonable in attaching value to engraved stones, Lionardo goes on to say: "All things in nature have a certain form, and are subject to certain influences. So, also, precious stones, being natural productions, have a prescribed form, and as such are subject to the universal influence of the planets. Hence, if these stones be engraved by a skilful person, under some particular influence, they receive a special virtue, as if they had been endowed with additional power through that engraving. And should it happen that the power intended by the engraving be the same as that of the natural quality of the stone, its particular virtue will be doubled, and thereby its efficacy greatly augmented." The ancient writers give numerous prescriptions as to the proper use and application of engraved stones. It is not a little curious to observe many of the rules laid down as the employment of various "charms." Thus, "a ram or a bearded man's head [the god Ammon] engraved on sapphire, will protect the wearer from all infirmities, from poison and from oppression." An engraved beryl, "with the dragon in front, has power to evoke the water spirits and force them to speak; and it will also call up the dead of your acquaintance, obliging them to answer your questions." Another Greek writer lays it down that a stone engraved with a design showing "a man with a long face and beard, his eyebrows raised, sitting behind a plough, and holding up a fox and a vulture, with four men lying upon his neck," will, "when placed under your head while sleeping, make you dream of treasures, and the right way of discovering them." There were most remarkable virtues in another kind of cut stone, representing Hercules and Jole, "Man seated, and a woman standing before him with her hair hanging down loose on her back, the man looking up to her: this cut on carnelian has the virtue that whoever is touched therewith shall be led to the owner's will immediately." And again, as related by Lionardo, "Man with a wand in his hand, seated on an eagle, engraved on hephaestitis [carbuncle], or crystal, which stone must be set in a copper ring: whosoever looks upon it on a Sunday, before sunrise, shall have victory over all his enemies, and if he looks upon it on Thursday, all men shall obey him willingly. But he must be clothed in white, and abstain from eating pigeon." Highly recommended was another gem engraving, upon "Chalcedonius," a species of smaragd, so called from being met with in copper mines near the city of Chalcedon. We learn that "a goat engraved on chalcedonius leads to amass wealth: keep this in thy money-box, and thou art certain to get rich." It is sad to record that the ancient chalcedonius, frequently referred to by Pliny, is no more found, the mines of Chalcedon having become exhausted more than a thousand years ago. The stone now going by the name of calcedony is not a smaragd, but an agathe-onyx, closely allied to, and scarcely to be distinguished from the Hungarian opal.

The faith in engraved stones as constituting "charms" and "amulets" flourishes, as is well known, nearly as vigorously in the East at the present day as it did in ancient Greece and Rome, and is not extinct even in Europe. There are few potentates in Asia or Africa who have not around their neck, mostly pressed against the heart, some gem to protect them against evil. The late King Francis II. of Naples wore constantly a necklet made up of engraved "amulets," supposed to be similar in virtue to the Greek stone with the man on the eagle, which conferred "victory over all enemies." To these "charms" his majesty trusted to the very last—until, it is to be supposed, General Garibaldi had driven him from home and throne. Throughout Spain and Italy there exists, among the lower classes, full faith in "amulets," especially in such as adorn the statues of the Madonna and the favourite Saints. In the rest of Europe, the belief met its death-stroke in the advent of Protestantism. However, it is related by Vaughan, Bishop of Chester, that Queen Elizabeth cured, by touch, scrofulous diseases "by virtue of some precious stones belonging to the crown of England that possessed this miraculous gift." This was evidently still the belief in Queen Elizabeth's time, though it is more than doubtful whether the strongly-minded Royal lady shared it. What is not doubtful is that she was strongly attached to precious stones—*as* precious stones.

Gems as "Concentrated Wealth."

While, in former times, gems were valued chiefly for objects which we now call superstitious, the modern view of them, that as representatives of riches—the artistic aspect, that of representations of beauty, being quite a secondary one, since the *shape* of gems, leaving alone their lustre, is very inferior to that of gold and silver ornaments produced by the jeweller's and goldsmith's art—necessarily gave rise to a great change in the appreciation of their value. Many of the gems of the Grecian and Roman periods, which were then thought most costly, are of little value now; while, on the other hand, some more scarcely looked at in former times, are now reckoned among the precious stones. Strictly speaking, the term "precious" is now generally reduced to about half-a-dozen among the gems, the remainder going by the appellation of "half-pure," or "half-precious." At the head of the precious stones stand the diamond and the ruby—the latter, under circumstances, more valuable than the former. To some extent it may be said that a certain market price, determined by size, form, purity, and colour, attaches to diamonds and rubies. This can scarcely be said as regards other precious stones and still less of the long list of "half-precious" gems.

At the head of all precious stones, by almost universal consent, stands the diamond, although, as just mentioned, the ruby may be, at times, higher priced. Not only its striking lustre, but the fact that it is the hardest of known substances, marked the diamond at all times as the king of gems, and as such it has kept its position to this day. Its extreme rarity, too, when of any considerable size, helped much to keep up the high position of this most coveted of precious stones. Already Pliny remarks, speaking of the diamond in his Natural History, "of its bearing the highest value, not merely amongst gems, but among all human possessions," and of its having been "long not known to any but kings, and to but very few even of kings." Substantially the statement of Pliny is still correct, since there are many more kings than large and famous diamonds in the world.

(*To be continued.*)

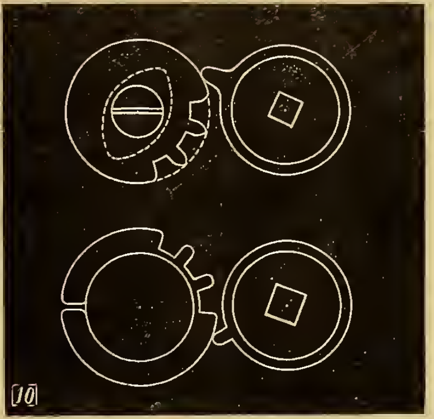
Composite Diamonds.—A diamond expert of Chicago asserts that many of the so-called solitaires, sold as single stones, are made up of small stones cleverly put together. Under the blowpipe they separate. He adds the surprising statement that not one diamond in ten sold in that country is other than the refuse of the London market. Nearly all are off-coloured, specked, or feathered, and are sold at a fictitious value.

THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.*

By M. Grossmann, Watch Manufacturer,
Glashuette (Saxony).

(*Continued from page* 19.)

42. The most common of these frictional stop-works, though not often seen in watches, has a wheel in which only three or four teeth are cut, and all the rest of the periphery left full. This wheel is screwed, with a stop-screw, to the plate, and the end of the barrel arbor carries a finger or tooth gearing into it, and moving one tooth of it at each revolution of the arbor. At the beginning and end of the winding range, the tooth butts against the full part of the wheel's circumference, and prevents further motion of the arbor in this direction. It is evident that during all the time between two passages of the tooth, the stop-wheel is without any control whatever, and might move round its axis by any external shocks if the freedom of its motion was not checked by a stiffening spring, causing sufficient friction. Sometimes the stop-wheel is reduced to a narrow rim, and is open at the place opposite the teeth, so that it is sprung on a little undercut stud spared from the substance of the barrel cover, thus gaining its hold without any screw or spring.



Figs. 11 & 12.

43. To the same class belongs a kind of stop-work, forming, as it were, an inward gear. An encentric annular groove is cut into the barrel cover, a little undercut at its outer edge. This groove holds an annular spring, in the inner edge of which some teeth are cut in which the stop-finger is to gear, and to limit the winding by coming into contact with the plain part of the spring. The friction of the latter in its groove prevents any untimely movement. It is obvious that this arrangement is liable to the same objections as the former ones.

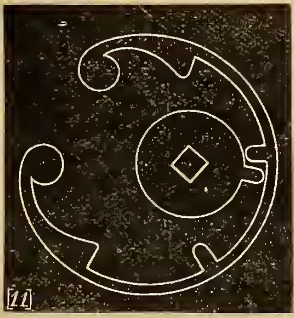


Fig. 13.

44. Of the other class of stop-works, operating without friction, we mention a very judicous arrangement frequently met with in the better class of Swiss and French watches of about fifty years ago. It consists of two small toothed wheels gearing into each other; the one on the barrel arbor having some teeth more than the other one, so that the same teeth of both wheels meet only after a certain number of turns allowed for the winding. Both the wheels have on their upper side, fastened in a solid way, a stop-piece of steel, and these two stop-pieces, when meeting, stop the motion by butting in a right angle. The mechanical perfection and reliability of this stop-work are beyond doubt; but it has the drawback of requiring an additional height for the stop-pieces placed over the two wheels; and it is easy to find that by the same quantity the breadth of the main-spring must be restrained.

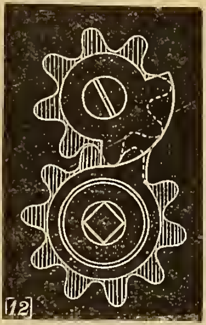


Fig. 14.

45. The stop-work, with the Maltese cross (fig. 15), is the most in use for watch-work, and deserves this preference. It is too well known to require a description. It is true that the careless way in which this stop-work is often executed in the lower grades of watches is a source of trouble and disappointment, both to the wearers of the watches and to the repairers. It must be well understood that the Maltese stop-work does not admit of any neglect in its construction; but if well made it is perfectly safe, and it only requires a judiciously arranged set of tools to manufacture them in an irreproachable manner.

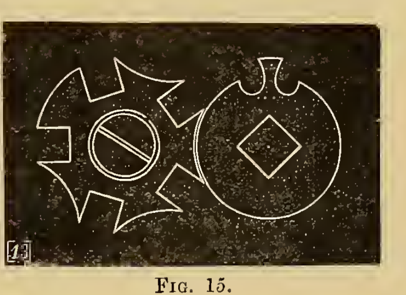


Fig. 15.

46. Still the stop-work, however well it is made, is only an unavoidable evil, because it complicates the mechanism, consequently rendering it more liable to disorder and failure; and it takes away part of a place which might otherwise have been devoted to extra breadth in the main-spring. It is therefore no wonder that the question has been earnestly considered, whether it would be possible to dispense entirely with the stop-work, without compromising the solidity or the rate of a watch, and without exposing the main-spring to any disproportionate strain. This question deserves careful study, for the advantages to be derived from the suppression of the stop-work are of considerable importance. Thus it will only be necessary to investigate whether these advantages are not outweighed by some grave inconveniences.

(*To be continued.*)

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* All Rights reserved.

THE PERMANENT EXHIBITION OF WATCHES, CLOCKS, MUSICAL BOXES, AND JEWELLERY AT GENEVA.

SOME time ago we called the attention of our readers to the above institution, which has now passed from the experimental to the practical stage, and, it appears, with every prospect of success. A branch of this establishment is shortly to be opened in Paris, at 16, Avenue de l'Opéra.

We have now before us the statutes of this society, which clearly define its objects. They are :—

1. To bring the manufacturers of watches, clocks, musical boxes, and objects of the allied arts in direct communication with consumers, and to undertake the sale of their products.

2. To protect the consumer by guaranteeing the origin and quality of these manufactures.

3. To make awards to industrials on the occasion of competitive exhibitions organised by the society.

The society attends, therefore, to the moral and technical, as well as commercial interests.

It is founded with a capital of 125,000 francs, with power to double the same if necessary. The shares are of 100 francs each, which entitle to interest at the rate of 5 per cent. and dividends as provided by the statutes.

Application for shares will be received by the following establishments in Geneva :—

Siège Social, Rue du Rhone, 1.
Messrs. Lombard, Odier and Co., Corraterie.
Comptoir d'Escompte, Rue Diday.
Banque de Genève, Rue du Commerce.
Conditions :—50 francs on application.
,, ,, 1st January, 1881.

The management of the society is entrusted to an administrative council, and the director nominated by statute, Mons. Charles Magnin, formerly President of the Tribunal of Commerce, of Geneva.

The following is a list of the present exhibitors which is published every month by the organ of the Society, *L'Industriel Suisse* :—

Baud, A., watch manufacturer, Geneva.
Bachschmid, F., ditto Chaux-de-Fonds.
Beaujeux, J. B., ditto ditto
Bonnet, J. A., manufacturing jeweller, Geneva.
Bornand, A., watch manufacturer. Ste-Croix.
Bousset, V., clock manufacturer, Morez.
Mmes Brun-Genton, manufacturers of filigree, Geneva.
Calame, Eugène, watch manufacturer, Neuchâtel.
Cattin, frères, ditto La Ferrière.
Chopard, G., ditto Sonvillier.
Delattre & Rambosson, manufacturing jewellers, Geneva.
Diacon, Fritz, watch manufacturer, Geneveys-sur-Coffrane.
Dreyfus, cadet, ditto Geneva.
Dumont, L., ditto ditto
Dufour, J. E. & Co., ditto ditto
Dufaux, Marc, enameller, Geneva.
Dupuis-Rey, manufacturing jeweller, Geneva.
Elffroth, ditto ditto.
Art Industrial School, Geneva.
Favre, frères, watch manufacturers, Neuveville.
Friesz, Auguste, glass engraver, Geneva.
Gostkowski, Laurent, watch manufacturer, Geneva.
Goy, frères, ditto Sentier.
Grosjean, Henri, ditto Geneva.
Gundina, père, ditto ditto
Gueissaz, frères, musical-box manufacturer, Ste-Croix.
Guinand, N., Haldimann, watch manufacturer, Brenets.
Guinand, frères, watch manufacturer, Brenets.
Haas-Privat & Co., ditto Geneva.
Haas, B., Jne. & Co., ditto ditto
Hantz, Georges, sec. jeweller, ditto
Hoffer, Jules, watch manufacturer, ditto
Humbert-Ramus & Co., watch manufacturer, Ch-de-Fonds.
Jacottet, C. F., ditto Neuchâtel.
James Kahn, watch manufacturer, Geneva.
Kervand, manufacturing jeweller, ditto
Lecoultre, Eugène, watch manufacturer, Geneva.
Leuba-Prince, clock manufacturer, Geneva.
Magnin & Guédin, watch manufacturer, Geneva.
Mathey-Claudet, ditto Ponts-Martel.
Matthey, André, ditto La Ferrière,
Matthey, Henri-Léo, ditto Locle.
Meylan, Ch. A., ditto Geneva.
Monod, E. ditto ditto
Moré et Hoffer, ditto ditto
Morel & Chuit, manufacturing jeweller, ditto
Müller, J., watch manufacturer, Geneva.
Nicole Frères, musical-box manufacturer, Geneva.
Perret & Co., chain manufacturer, Geneva.
Petit-Pierre, Marc, manufacturing jeweller, Geneva.
Piguet, A., musical-box manufacturer, Geneva.
Léopold Piguet, watch manufacturer, Brassus.
Pötter, painter, Geneva.
Robert-Stauffer, et fils, watch manufacturer, Ch.-de-Fonds.
Redard, H. & fils, ditto Geneva.
Rutishauser & Douillon, manufacturing jewellers, Geneva.
Sauter, F. S., watch manufacturer, Chaux-de-Fonds.
Schöchlin, W., ditto Bienne.
Tissot, Alfred, ditto Ch.-de-Fonds.
Tripet et Brach, ditto Villeret.
Weil, M., ditto Geneva.

The *Tribune de Genève*, in announcing the formation of this society, says :

"We have learnt with great satisfaction that a society has been formed in our town which has for its object the permanent exhibition of watches, clocks, musical boxes, jewellery, and kindred art objects. The society starts with the exhibition instituted by M. Ch. Magnin, Place Bel-Air, which must serve as a type for similar establishments elsewhere, and particularly for the one which is to be opened at 16, Avenue de l'Opéra, Paris.

"We think it the duty of every manufacturer to join this enterprise, as it will certainly prove an element of strength to our languishing industry. The powerful competition of to-day requires that manufacturers should unite to obtain the services which could not be secured individually. Our manufactures have made common cause in securing a worthy representation of our products at the Melbourne International Exhibition, an example which must be followed and take a permanent character, so that the advantages gained may not be lost again. In fact, universal exhibitions give, as a rule, but very poor results to those that take part in them, if the necessary sacrifices are taken into consideration; in these solemnities the really practical part is often sacrificed to the mere appearances, to that which shines; besides, in many cases, manufacturers can only be induced to take part in these industrial struggles with State aid. In the Genevese Society of Permanent Exhibitions we have now a commercial organisation which will not only prove advantageous to manufacturers, but also to the shareholders.

"Such are the objects which the founders of the society have in view, and we heartily wish them the success they merit."

We may add that the shares are not exclusively reserved for the exhibitors. Persons desirous of becoming exhibitors or shareholders should address the director, M. Charles Magnin, Rue du Rhone, 1, Geneva.

THE GOLDSMITHS' COMPANY.

"RECENT circumstances in connection with the sale of some spurious Queen Anne plate," says the *Citizen*, "have brought prominently before the public notice the powers and functions of the Goldsmiths' Company. The right of the Company to continue the exercise of control over the gold and silver trade has been questioned, and an Association appears to have been formed under the name of the "Goldsmiths' and Silversmiths' Free Trade Association," for the purpose of abolishing the existing rights of the Goldsmiths' Company. The resolution recently adopted by this Association is sufficiently warlike and drastic to deserve re-production, especially as the chairman, Mr. E. J. Watherston, is a member of the Company. The Association resolved:—

> 'That, inasmuch as the Goldsmiths' Company have for many years past failed to observe the terms of their charters, which direct that the Wardens shall be "elected by the trade," and that they shall be "true, honest, and sufficient men, best skilled in the said trade," and whereas the Wardens have been, and are, illegally elected, and for the most have been, and are, wholly unconnected with the craft, the Company have, *ipso facto*, forfeited their charters, and, with them, their right to interfere with the trades in the precious metals, steps be taken to challenge their right in one of Her Majesty's courts of law upon the first available opportunity; that an opportunity be at once sought by exposing for sale duty-paid but unhall-marked foreign manufactured silver plate; and that a copy of this resolution be forwarded to the Prime Minister, the President of the Board of Trade, the Attorney and Solicitor-General, the Lord Chancellor, and the various assay offices throughout the kingdom.'

"The resolution is sufficiently portentous; but perhaps the Goldsmiths' Company would have wisely left it unnoticed, if it had not happened that the shopkeeper who recently sold more than 600 pieces of Queen Anne plate also declined to recognise their authority, and treated their demand for £6,000 worth of penalties with contempt. It was of course impossible for a body like the Goldsmiths' Company thus to allow their authority and indeed there very *raison d'etre* to be questioned, and so at last they have told us what there is to be said and done in the way of defence. Unless we are much mistaken, the letter which has been sent to the papers on behalf of the Company is written by the Clerk of the Company, Mr. Prideaux, and is therefore possessed of sufficient authority to enable us to judge of the position which the Company propose to take up. And the most remarkable feature of this letter is the fact now alleged that 'the Company do not exercise their powers and functions under any charter but under Acts of Parliament.' We are of course quite aware of their powers under the various Acts of Parliament, but surely it is a most astounding thing for the Clerk of the Goldsmiths' Company to say that the Company 'do not exercise their powers and functions under any charter.' Does Mr. Prideaux mean to admit what his words imply, that if the Acts of Parliament to which he alludes were repealed the functions of the Company would forthwith cease? If so, then we should like to know under what authority the Company acted before the Acts of Parliament were passed. Mr. Prideaux has taken up a false position, as it appears to us, in order to avoid the mischief aimed at in the resolution of the Free Trade Association. But he must be perfectly aware that the contention of his Company is that the charters empowering the Company to hold land and to control trade, are still in force. If they have not powers under those charters as to these matters, is it not likely that the City Guilds Commission may ask on what ground they claim to continue possessors of the land, power to hold which was granted by the same charters?

"The charter alluded to in the resolution of the Association is no doubt the charter of 1327, granted by King Edward III. on the petition of the Goldsmiths of the City, and under which the trade might rent good men who should have full control over it, and all men practising the same were not to keep any shop 'except in Cheap.' This, however, was not, we believe, the incorporating charter of the Company. This was granted by Richard II. in 1393, and he licensed the Goldsmiths of the City to be thenceforth a perpetual community, a society of themselves, and that they should yearly elect from out themselves four Wardens to duly oversee and govern the mystery and commonalty, and the King thereby empowered the Wardens and commonalty to purchase lands in mortmain for the relief and maintenance of the blind, weak, and infirm men of the Company. This charter incorporates a previous charter granted by Edward III., whereby it is recited that the blind, weak, and infirm became so by reason of fire and the smoke of quicksilver, and by working in the same trade. Now, all the persons then incorporated were working or master gold or silversmiths. The land was allowed to be held upon that understanding, and the power given by these charters to oversee and control the trade was given to Goldsmiths as such. Edward IV. gave the Company extended powers for the 'preventing and avoiding of frauds,' and gave to the Wardens the trial and inspection, search, and regulation of all sorts of gold and silver, wrought or to be wrought, and exposed to sale within the City and the suburbs thereof, and in all places throughout England. He also gave them power to prevent and correct all defects found in the working of gold and silver, and to destroy deceitful wares. Henry VII. confirmed these charters and gave further powers to the Wardens. They were authorised 'to commit offenders to gaol, and to seize, break, and deface all deceitful wares, and to make searches for the same in London and within three miles of the same, and that all Goldsmiths' works and jewellery of gold or silver so made within the aforesaid limits shall be brought to the Hall to be assayed and stamped with the marks used for that purpose.' Succeeding monarchs, down to Charles II., continued and strengthened these powers. Does Mr. Prideaux now mean to suggest that they are non-existent or merely dormant? In either case the question arises whether, the charter being now inoperative, they are forfeited, as the Free Trade Association suggest. And if they are forfeited, what becomes of the vast property which has been allowed to accumulate in their hands under the power given to working goldsmiths for the benefit of working Goldsmiths. These are serious questions for the Company, and we doubt whether the City Guilds Commission will report that the Goldsmiths are carrying out the objects of their foundation when they treat the foundation as inoperative.

As to the powers exercised by the Company under the Acts of Parliament there is this to be said—that Parliament in granting these powers granted them to the Goldsmiths' Company upon the assumption that it was composed of men of the trade. Does anybody suppose that such powers would have been granted to the Fishmongers, or the Pattenmakers, for example. If Parliament had been aware that the present state of things as to connection with the trade is such that during eleven years, out of the forty-four Wardens no less than forty-one were quite unconnected with the trade, it may be doubted whether such powers would have been granted. It is now urged that such powers should be taken away and the Acts repealed. In the 12 Geo. II. chap. 26, whereby powers are given to the Goldsmiths' Company of London, and to other companies of Goldsmiths in other parts of the country, the charters granted to the company are recited, and the special powers given to them by various kings down to King Charles II. set out and enumerated. But this Act contemplates, with respect both to the Goldsmiths' Company of London and to the other Goldsmiths' Companies mentioned it it, that the members of the companies are actual members of either the Goldsmiths', Silversmiths', or Plateworkers' trades. Nothing can be more clear than this, and it is only upon this understanding that powers are given to them to examine, and assay, and to destroy bad work. The ordinary inference from this would seem to be that so soon as the Company ceases to be composed of working artificers and actual Goldsmiths or Silversmiths, so soon does it become an open question whether powers which are only rightly exercised by either Government officers or by acknowledged rulers of a trade should be conferred upon or continued to companies that are only trading companies in name. It is only in the capacity of a company of actual Goldsmiths that the Goldsmiths' Company were ever given powers over the trade, and the other statute referred to by Mr. Prideaux—the 7 and 8 Vict. c. 22—is merely a continuation and extension of powers given to the Company when it had a representative character. These considerations have much importance in view of the agitation for reform which is being initiated by the Free Trade Association. As to the particular case which has aroused all this interest in the matter, it is very likely that the Goldsmiths will find themselves worsted. If it should turn out that the assailed tradesman discovered to the Company the name of the person from whom the articles were bought within the time mentioned in section 4 of the Act, it is difficult to know why he does not become 'exempted and discharged' from further liability according to the express provisions of the section. The Company are clearly able to sue for penalties. There can be no doubt as to that, but whether in the particular case they are not restrained by other matters of law and fact, is open to question. Whether the right to sue ought to be continued to a Company which has lost its representative trade character, is one of those more difficult questions which the City Guilds Commission may perhaps help us to solve.

SAPPHIRE MINES OF SIAM.

THE year 1879 will long be memorable in the provinces of Battambong and Chantaboon for the discovery of valuable sapphire mines and for the great influx of foreigners, chiefly from British and Independent Burmah, to work them. There have long been mines of inferior value in this neighbourhood, and about five years ago new mines were discovered by a native hunter. Being, however, in a very remote and secluded position, it was some time time before the fame of the new mines spread to the Burmah and Indian gem traders and miners. Some individual diggers, however, having found their way to the mines, and having returned to Rangoon and Calcutta with the proceeds of their work, realised very large sums, and a rush for the new mines commenced and continued throughout the last year, during which many thousands of British subjects passed through Bangkok from British Burmah on their way to the mines. The arrival of those large bands of armed strangers caused considerable alarm among the natives of Chantaboon and Battambong, who could scarcely be persuaded that the country was not invaded once more by the old hereditary enemies of Siam, the Burmans and Peguans. The miners, however, by their peaceable behaviour, restored confidence, and the country people soon were glad to sell them all kinds of provisions at enhanced rates.

The miners, in their haste to become rich, disregarded all considerations of health, and immense numbers died from jungle fever. The Toung-thoos from Pegu proved the most capable of standing the climate, and, many having made money and returned successful to their homes, the rush continued unabated for a long time; but now the great mortality is beginning to tell, and the broken health and emaciated appearance of most of those who return will check the eagerness of others to try their fortunes in this fever-stricken district.

The governor of the province has hitherto levied 2¼ ticals (5s. 7½d.) from every man working at the mines, and this is cheerfully paid. Good order has hitherto been maintained, and the governor has appointed a British subject, named Kam Sai, to act as headman and to collect the licence duty.

The Siamese authorities do not regard with entire complacency this conveyance from their soil of these valuable gems without payment of royalty. No definite proposition has, however, yet been made to impose any other than the licence tax above mentioned. There would probably be found considerable difficulty in collecting any sort of *ad valorem* duty. As it is, the discovery of the most valuable stones is kept as secret as possible by the fortunate finders, and should any *ad valorem* duty be attempted to be imposed, the tax-gatherer would probably be defeated by craft or force.

One of the miners who was in Bangkok on his return from the diggings, a poorly-clad and miserable looking individual, on being applied to, produced a few small stones, and, after a great deal of coaxing, was induced, with many precautions, to give us a private view of his great prize, which was a very large sapphire in the rough, which he valued at 20,000 rupees. He would probably not have shown this stone at all had he not been on the point of leaving in a steamer. Owing to the secrecy thus observed by the possessors of valuable gems, it is impossible to give any estimate of the total value of stones found, but that individuals have made very large profits is certain. There is a man now in Bangkok who dug out a stone which he offered for sale in Chantaboon at 1,000 rupees, but did not find a purchaser. He went with it to Rangoon, where he was offered 15,000 rupees; but, having then awoke to the value of the stone, he declined to sell and took it to Calcutta, where he eventually obtained 30,000 rupees for it. Now, however, there are many experienced gem merchants established in the neighbourhood of the mines, and something like the real value of the stones can be obtained by the miners on the spot.

Many of the miners finding themselves in cash have invested in the luxury of wives taken from the Siamese population, and the value of marriageable young women, who are at all good looking, has in consequence gone up to a very high figure.

The largest sapphire hitherto found, which I know of, weighed 370 carats in the rough, and when cut turned out 111 carats of the finest water. The ruby, onyx, and jade, are also found in the district, but the quality of none of these is such as to make them very valuable.—*From the Commercial Report by the Acting British Consul-General in Siam for the Year* 1879.

THE WATCHMAKER JEWELLER AND SILVERSMITH'S TRADE JOURNAL.

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

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CONTENTS.

	PAGE
The Time Work and Time Signals of the Greenwich Royal Observatory	35
Hard-soldering Wedding Rings, &c.	36
Practical Instructions to Jewellers, Silversmiths and Electro-platers	37
Repairing Swiss Watches	38
The Silver Trade	39
New Winding Mechanism for Going Barrels	40
Argentine	40
Machine Work *versus* Hand Work	41
Book Notice	41
A Few Words on Gems and Precious Stones	42
The Construction of a Simple but Mechanically Perfect Watch	43
Queries and Answers	43
Bronzes	44
Hints to Repairers	45
The Art of the Silversmith	46
Patents	i
Monthly Record of Bankruptcies	ii
Directory	iv
Advertisements	i—xii

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THE TIME WORK AND TIME SIGNALS OF THE GREENWICH ROYAL OBSERVATORY.

By C. Stuart Murray.

(*Continued from page* 24.)

THE state of the sidereal standard clock has to be ascertained; it has to be compared with the mean solar clock, and that clock has to be brought to time. To effect these the transit from the chronograph cylinder-paper is read off, certain corrections are made, and the true time of the star passing the meridian ascertained. But the transit instrument itself requires correction occasionally, notwithstanding the ingenuity with which it has been built for strength, and the foundations and piers upon which it rests. Temperature acts upon it, as it acts upon the balance-spring of a watch, although it seems hardly feasible that two tons of cast iron, enclosed within thick walls, and carefully tended, should sensibly feel the effects of heat and cold. But it is so, and although the errors are small, still they *are* errors, and have to be eliminated.

The standard sidereal clock is one of the marvels of mechanical horology. It is fixed to the north wall of that part of the Observatory known as the magnetic basement, the temperature there only varying a few degrees throughout the year. It was made by Messrs. E. Dent and Co., in 1871, and is somewhat peculiar in its action. As far back as 1826 the present Astronomer-Royal read a paper before the Cambridge Philosophical Society "On the Disturbances of Pendulums and Balances, and on the Theory of Escapements." That of the clock under notice is of the same character. The escapement is a detached one, having an affinity to that of the chronometer. The pendulum impulse takes place at each double of vibration so that the seconds-hand moves only once every two seconds, those seconds being the even ones. The pendulum is hung from a solid large brass casting firmly attached to one of the basement walls. It has a zinc and steel compensation and a leaden bob, and the driving weight slides down a prepared "shoot," to avoid vibration did it move freely. The first zinc tube rests on the rating nut, then a steel one goes over that resting at its upper end upon the zinc, and carrying at its lower end the leaden bob; the weight of the bob is about twenty-six pounds; the rod is of steel. The compensating tubes have slots and holes cut in them the better to allow the temperature to circulate. Upon the crutch axis, held by friction, are two straight brass and steel compensating bars, carrying at each end a small compensating weight, whilst along the crutch-rod is a spindle tapped and nutted at the upper end, and carrying a square weight at the lower end. This spindle is for enabling very small changes of rate to be made without stopping the pendulum. The driving weight is only about 5¼ pounds. There is a magneto-barometric arrangement to counteract barometric error, so that as the mercury in the barometer rises and falls its float produces magnetic action between it and the magnets of the pendulum. These are two bar magnets, each about six inches long, fixed vertically to the front and back of the pendulum bob. Below them is a horse-shoe magnet attached to the end of a lever, the other end of which is joined by a rod to the float on the mercury in the syphon of the barometer. The lever rests on a knife edge. It will thus be understoood that as the float on the mercury rises or falls it moves the lever, the magnet of which acts correspondingly on the magnets of the pendulum either to advance or retard it. The general work of the sidereal clock is to drive sidereal relay, which relay closes three pairs of springs completing as many circuits. One circuit registers the clock seconds on the chronograph previously mentioned, "another controls the half seconds pendulum of a clock near to the hour circle of the great equatorial, driving the fifty-nine seconds clock, and working a sounder to render audible anywhere in the dome the beats of the standard sidereal clock, whilst a third closes the circuit for controlling the balance of a chronometer attached to the eye-piece of the equatorial telescope."

Mr. Criswick took us into the principal computing room and explained to us what was there. Upon the time superintendent's desk is a small electric dial, the hands of which are driven by a separate wire. Only fifty-nine seconds for each minute are sent by the sidereal clock through the "relay." The stoppage of the 60th second at the end of each minute is to prove whether or not the two clocks agree. We were shown that if the seconds hand stops at what would have been one second after the minute, the dial is in correct sympathy with the parent standard sidereal.

The error of the standard sidereal clock having at length been found and booked, from the star observations of the previous night, and that the fifty-nine seconds clock is in sympathy with it, close beside it there is on the same desk a small mean time solar clock, only a few inches off. This has now to be compared in order to ascertain and correct its error. Previous to doing so, however, Mr. Criswick conducted us to the mean solar standard clock, which he calls "the parent of this system." Its home is across the court yard under the time-ball. The room in which it "moves, lives, and has its being" is a closet about five feet square, having one window to it. Opposite to the "mean solar" was a companion of its toils, a relic in its way. This aged "shipmate" bore the following inscription upon its dial—"Geo. Graham, No. 3." It is in an old mahogany case, and its rate is still so good that, like an old sentinel, it is kept there and consulted as a check upon the work or escapades of its young friend against the opposite wall. A word about that young friend.

The mean solar standard clock is entirely an electric one, with a pendulum. It was put up some thirty years ago by Messrs. Shepherd and Sons, of Leadenhall Street. A small weighted lever keeps the pendulum in motion, worked by the armature of an electro-magnet. The electrical relay from this clock controls a clock at London Bridge station, one in a front window at the works of the Messrs. De la Rue, Bunhill Row, and one in the Horological Institute, Northampton Square. This clock also gives the hourly time signals all over the country, and the public may see a sympathetic set of hands and dial worked by the same clock in the wall of the Observatory by the gate. That clock has no pendulum, the movement being kept going by the oscillation of two permanent magnets through positive and negative currents of electricity. The swinging of the pallets drive forward the escape-wheel, and that sends round the motion wheels of the hands. That clock has hour, minute, and seconds circles, the latter being below the centre. The dial is figured up to 23 in the hours, the 24, or noon, being 0; the minutes are ticked and dotted on a circle outside the hour figures, whilst the seconds are marked in the usual way as upon regulators.

The gentleman whose business it is to ascertain the exact time having by means of the wires brought together that of the standard sidereal clock and the mean solar standard, nothing remains but to compare them by the method of coincidences. This can be easily effected within two or three tenths of a second, by means of an instrument called a commutator, which is on the time superintendent's desk between the small sympathetic dials already spoken of. The same principle that is used in the barometric compensation with the magnets to alter the rate of a pendulum without stopping it is brought into play here to correct the error of the mean solar standard clock. The pendulum rod has fixed to it on the front a permanent bar magnet about six inches long; this magnet has the north pole downwards. There is a hollow coil in circuit with a galvanic battery, which is not in action in its ordinary state. Let us suppose that after the mean solar standard and the small mean time clock on the superintendent's desk have been compared together the small one is found to be half a second too fast. The dial of the commutator has the words "retarding" and "accelerating" engraved upon it. In the present case the handle of the instrument is turned over to "retarding," which turning sends a current through the hollow coil just mentioned, making its upper end a north pole, and consequently repelling the lower end of the pendulum magnet, and "retarding" it—that is, making it go slower. The battery power is so adjusted that if the retardation is kept in action for ten minutes the pendulum will have lost one second. When the clock is found to be slow, an accelerating turn is given to the commutator handle, and the pendulum gains to the same extent that it lost, and in the same time, which is done in this way. A wooden bracket in the clock case has a small bundle of soft iron wires fixed to it, and by friction can be made to slide to or from the south pole so as to act on the pendulum. The nearer this bundle goes to the pendulum magnet the more the clock will gain on its rate, whilst the farther it recedes the more will the clock lose.

HARD-SOLDERING WEDDING RINGS, &c.

Hard soldering of wedding rings or similar solid gold articles can be effected with the following alloys. Twenty-two carat articles may be soldered with 15 carat gold, 18 carat articles with 12 carat gold, and 15 carat articles with 9 carat gold. For articles which are not quite solid, or have been soldered in several places, an alloy of two parts of the same carat gold as the articles are made of to one part of silver solder will answer the purpose. The solder for wedding rings may be in the shape of thin plate pressed between the joining, and brushed over with thick borax, by which means a clean soldering is effected. Coloured gold rings may be restored after soldering to the original colour by throwing the ring whilst wet into a powder made of two parts saltpetre, one part of alum and one of salt, placed upon charcoal and exposed to the flame through a blowpipe until dark yellow, and then be boiled in dilute sulphuric acid and rinsed. If the article after this treatment is not of the rich yellow colour, the manipulation may be repeated. The colour produced in this manner is far more durable than ordinary gilding, and, in fact, less troublesome.

H. Bush, Hull.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. XVIII.

(Continued from page 25.)

GILDERS usually employ three baths, placed in close proximity to each other, and heated upon the same furnace; the first bath is one deprived of gold by a previous operation, and is used for removing all excess of acid which may remain upon the articles; the second bath still retains some gold, but not enough to give a sufficiently rich gilding. The pieces passed through it begin to receive the deposit, which will be finished in thickness and shade in the third bath. A gas furnace, easy to manage, and clean in its working, may be arranged by having a properly supported sheet-iron plate with holes cut out where the kettles are to stand. Under each kettle place suitable gas burners; when the baths have been heated nearly up to boiling point, lower the gas, so as not to increase the temperature. This method produces much more gilding with a given quantity of gold than one bath alone. The gilding is done in a few seconds; the finishing operations consist in rinsing in fresh water, drying in dry and warm sawdust, and burnishing if desired. The sawdust of white woods, such as pine, lime-tree, poplar, free from gum, dust and other impurities, answers best for drying purposes. Oak and chestnut sawdust blacken the gilding.

Colouring Process.—If any of the precautions indicated previously are neglected, it often happens that the gilding turns out dull and irregular in colour. The colouring process is to remove these defects. Melt together in their water of crystallization, at about 212° Fahr.,

Sulphate of iron,
Sulphate of zinc,
Sulphate of alumina and potash,
Saltpetre, equal quantities.

Cover the articles with the mixture, so that every part is well wetted; then put them into a cylindrical and vertical grate placed in the centre of a furnace, where the charcoal burns between the sides and the grate which holds the articles. When the moistened finger is pressed to one piece, and a slight hissing sound is heard, the heat has been sufficiently raised; put all the articles rapidly into a very diluted solution of sulphuric acid, where the coating of salts is immediately dissolved. The articles present a warm and uniform shade of colour. This process is, of course, only applicable when the previous gilding has been done complete. If the copper articles are not entirely gilt by the first operation, the ungilt portions will show themselves by a red colouration, and the article must then be deprived of gold, cleansed, and gilt anew. The gilders of the present day generally employ the battery as well as the simple dipping bath, and when the first gilding by immersion is imperfect, instead of colouring by the process just described, the articles are placed for a few moments into the electro bath. As already stated, gilding by simple immersion is generally only resorted to in the treatment of the small articles which make up imitation jewellery. There is, however, an easy method by this process of obtaining as good results as by the battery. It consists in gilding several times by dipping; before each dipping, the article is passed through the solution of nitrate of binoxide of mercury. This repeated dipping method is very much used, and is applicable for gilding articles which are usually treated by the battery only, such as clocks, candelabra, bronzes, &c. Work manipulated by this system is superior to that by electricity in depth of shade, brightness, and especially in not sealing off, as the deposit is of pure gold only.

Ormolu.—This operation consists in smearing, by means of a brush, the gilt and scratch-brushed objects with a thin paste of nitrate of potash, alum and oxide of iron, which have been well mixed and ground under the muller, and to which has been added a solution of saffron annatto, or any colouring substance, according to the shade desired. If the gilding is strong and thick, the objects are heated until the previous coating curls over at the approach of a wet finger. If the gilding is a mere film, the mixture is simply allowed to stand upon the articles for a few minutes. In either case, the whole is rapidly washed in warm water, holding in suspension a certain quantity of the materials for ormolu; they are then rapidly dried, when they appear of a darker shade. Remove any portions too much coloured by striking them vertically with a brush having long bristles. If the tint does not appear satisfactory, commence the operation afresh, after washing off the ormolu in a diluted solution of sulphuric acid. Instructions for preparing the various shades of ormolu will be given when dealing with the chemical products used by the trade.

Green and White Gilding.—These shades may be graduated at will, and are obtained by adding drop by drop, until the desired shade is arrived at, to the bath of double pyrophosphate of soda and gold, a solution of nitrato of silver. For the solution of nitrate of silver, dissolve in five ounces of distilled water half an ounce of nitrate of silver crystallized, or of lunar caustic. Before gilding green or white, yellow gild the objects in the ordinary bath, then pass them rapidly through the mercurial solution, and, lastly, dip them into the gold bath holding the nitrate of silver, which parts rapidly with its silver upon the first articles steeped in it. It is necessary to maintain the constancy of the shade by the addition of a few drops of the silver solution when required.

Gilding Silver by Dipping.—The silver articles, previously cleansed and scratch-brushed, are boiled for about half an hour in the gold bath of pyrophosphate, to which add a fews drops of sulphurous acid, or preferably, hydrocyanic acid, in excess of the quantity needed by the primitive bath. This gilding is very fine, but without firmness. The deposit is rendered more rapid and thicker when the silver articles are stirred with a rod of copper, zinc, or brass.

Gilding on Porcelain, Glass, or Crystal.—Mix first in a crystal mortar and then between a muller and a ground plate glass, neutral chloride of platinum with rectified essence of lavender, so as to form a thin syrup, which is applied with a brush in very thin layers upon the glass, porcelain, or other ceramic objects. After drying, heat in a muffle up to a dark red; this temperature reduces the platinum to the metallic state; it then appears with a perfect polish. After cooling, pass the whole object through aquafortis, which is without action upon the platinum, but destroys the impurities which may tarnish its surface. Rinse in plenty of water, wrap the object with a few turns of fine brass wire, having numerous points of contact with the platinized places, and dip into the gold bath. After a few minutes the platinum is covered with gold which has the same adherence and polish. Rub the gold with a chamois leather; this method dispenses with burnishing, which is costly, and often impracticable in the deeply indented parts. If the gilding is too red, add to the bath a few drops of a solution of double cyanide of potassium and silver (liquor for silver electro-plating). This method gives better results than that of baths with separate battery; the gilding has a bright instead of a dead lustre, and its adherence is greater.

Dutertre's process for bright gold gilding, which consists simply in applying with a brush a mixture of sulphide of gold and various essences, which are then submitted to a dull red heat, has almost wholly superseded the previous process.

(To be continued.)

REPAIRING SWISS WATCHES.

No. I.

By H. GANNEY.

In attempting to write a few pages on repairing horizontal watches, now and for many years past the representative Swiss watch to such an extent that the terms horizontal and Swiss watch are considered equivalent, one cannot help wondering at the neglect of this truly useful escapement by English watchmakers, as it is the only escapement of undisputed English origin. The Chronometer, Duplex, and Lever escapements have as many claimants in France as England; and as I write I have before me a horizontal watch made by Graham, bearing his name, and two others of about the same make and age: one a repeater, and all of them little the worse for wear, and capable of useful service for 50 years to come. Great as has been the success of the Swiss with this watch, there is nothing that should have prevented a still greater success of the English with it, as when English, French, and Swiss were engaged in the manufacture of verge watches, prior to its invention the predominance was with the English, and the form of watch popular in England, the full plate, is better adapted to prevent dirt accumulating in the escapement than the Swiss cock watch, which almost looks like a special arrangement for the deposition of dirt in the escapement.

There is a great difference observable in modern and the earlier make of Swiss watches in this respect, the wheel sink of fourth wheel being cut away formerly to allow the inevitable dirt to pass elsewhere, while it now travels round the fourth wheel and sink continuously, until deposited in the escapement, and retained by the oil, which, being abundant in this escapement, soon accumulates more dirt than it can perform with. To this circumstance rather than any theoretical or practical superiority enjoyed by the lever watch as commonly made is due the rather low estimate of the horizontal watch. The latter being simpler in its parts, delivering the impulse direct from scape wheel to balance, requires less motive power, and showing less variation in its arcs of vibration under the varying motive forces, external influence, and temperature changes, advantages which indicate it as the watch for the everyday use of the million. For such purposes it is superior to the lever, but it is incapable of being developed like the lever in its best form to an equality or superiority to the chronometer for pocket timepieces.

One of the greatest evils connected with our art is the production of complicated mechanism, which is mere imitation of the higher class of lever work; but in sustaining this fallacy the horizontal watch bears no part, as it does not lend itself to fraud by carrying compensation balances or isochronal adjustments other than those natural to it as a frictional dead beat escapement. The correct adjustment required is shown in the simple construction of the cylinder, made to contain one tooth of the escape wheel within its diameter, and the cylinder itself passing freely within the space that divides two teeth of the wheel. The practice of purchasing cylinders ready made always, is to be deprecated, as nothing gives such facility in repairing escapements as making them; whilst errors in making are most conspicuous and most keenly avoided by those who have had constant experience of their annoyance as repairers. The most troublesome job in making a cylinder is drilling the hole in the steel, but this can generally be avoided, as most jobbers have plenty of old cannon or centre hollow pinions in their rubbish box, which in a few minutes can be opened to fit over the wheel tooth. An arbor put in a short distance and the pointed centre of the turns sustaining the other end, 20 minutes' work will produce a cylinder ready for hardening the cutting of cylinder nearly half way for escaping, and two-thirds for banking slot with a plug of brass wire through the cylinder. It requires no special tools, the files being already on every work bench, or they can be easily made or modified by filing and rehardening ordinary square files. The polishing of the inside of the cylinder is easily done on a soft steel arbor on which the cylinder revolves; two bows and ferrules being used, or the arbor may be moved by the fingers, whilst the cylinder is revolved by the ferrule and bow. The necessary heights and freedom will be indicated by placing wheel and cylinder in depth tool before putting in the pivots; the other operations are obvious to every workman. In altering escapements the workman has only to remember that all drop is wasted power, and that no drop means stoppage. In order to drive pivots out of cylinders, owing to the plugs being nearly as large as the cylinder, they must be started by resting on a chamfered or funnel-shaped hole; and the several punches used made to fit all the available space in the cylinder. A most useful tool for flattening, raising, or lowering the action of the scape wheel is a circular piece of brass or ferrule turned concave or saucer shaped both sides, and thick enough to prevent the pivot from coming through the other side when placed on the work board, and small enough to go inside the circle of the wheel teeth, the arms resting on the brass circumference. There will be a certain amount of space between the concave surface of the brass and the arms to the centre of the wheel, by giving two or three rubs up or down the arms with a piece of metal; a screw driver we use; they are brought in contact with the concave surface, and the arms receive some of its concavity, and are raised in proportion. Simple as this tool is, and made in a few minutes, we consider it the most useful we have in connection with Swiss jobbing, solving all the difficulties connected with raising or lowering hard steel wheels without the dangers attendant on the use of hammer and punch.

As all Swiss watches are so arranged that the escapement depth can be easily altered, an intelligent workman can always secure from even the commonest watch a tolerable escapement.

One of the weakest points about the horizontal watch is the fourth and scape pinion depth. The necessity of placing the fourth wheel under the scape wheel makes the wheels always close to each other and their respective bars and bearings, and when to an untrue wheel and soft pinion an indifferent depth is added, special vigilance is necessary. The putting of a new wheel and pinion to common watches entailing too great an expense, doctoring the wheel becomes the prevalent remedy. The new tool for rounding-up teeth truly has been a great boon, as a wheel can be enlarged, tipped true in the turns, or depth tool and the teeth reshaped properly, and the wheel all the better for the hammering it has received; otherwise the re-shaping of the teeth by hand with a small file was all that could be done, or a piece of mainspring held against the teeth whilst revolving in the turns was depended on to round somewhat the teeth, after being enlarged and trued.

We trust a brighter era is dawning, for bad work is always unprofitable to all concerned, and that the watch repairer, in addition to being required to possess skill equal to all the producers of horological instruments for their rectification when damaged, will not be required to alter or re-arrange the parts of watches to secure original performance. The development of machine-watch making, as practised by the Americans and lately introduced with success by Mr. Guye into Clerkenwell, will eventually prove the inutility of producing cheap and nasty hand-made watches. Another useful tool for improving teeth we have seen is based on the idea often acted on by jobbers, that bad teeth may be improved by being revolved in connection with a pinion. The tool is like an ordinary depth tool of large size, with centres made to receive the wheel pinion shoulders, and a number of short pinions of strong make; all sizes are provided, with the arbors to fit, and wheel and pinion being geared, a strong bow is applied, and the inequalities of the teeth are corrected and rubbed out by the pinion, which transfers its own true form of tooth to the wheel when revolved with power some time.

(*To be continued.*)

THE SILVER TRADE.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Mr. Editor,—A letter appeared in the *Times* of September 13th, under the signature of Mr. James U. Poole, which, both by its manner and its matter merits attention and comment from those who have taken an active part in the discussion of the silver question:

From the nature of the facts spoken to it is quite clear that Mr. Poole has had the advantage of an inspired communication from the quarter in which they are likely to be best known; we may therefore now rest assured that the attempt to bring to justice the shopkeeper in a large way, and the manufacturer in a small way of business, who "has been able to obtain very efficient legal advice, the defence set up being under the statute of limitations," has failed.

Granting that all may have been done that was in the power of the Goldsmiths' Company to do, and that they have done right in withholding the name of the dealer and his *employé* from the public, although it appears that they were quite well aware of the nature of the transaction they were engaged in, what comfort will those gentlemen, who found in Sir C. Russell so efficient a querist, derive from the knowledge that the organisation that has special charge over all transactions in silver plate is so helpless as in this instance it has shown itself to be?

The Goldsmiths of the olden time were troubled with similar difficult problems, and they sought to solve them by what really seems to be the only efficient method—they established what in modern times would be designated an excise. So far back as the reign of Edward III., in the 14th century, the Goldsmiths' Company, who were then all men belonging to the craft, petitioned the king for a charter empowering them to visit the workshops and make search for deceitful wares. The whole business in those days was in a nutshell as compared with the widespread arrangements for manufacture and sale in our time. As, according to Mr. Prideaux, the company wait till information is brought to them, there will not be wanting men unscrupulous enough, first to work up silver into imitation antique plate, thus defrauding the revenue, and then to sell it to persons for whom it is a necessity that they should at least appear to be in possession of whatever fashion may declare it needful that they should have.

Mr. Poole's letter is rather oracular in manner, and therefore somewhat ambiguous, and not a little obscure; what, for instance can be made out of the statement that "This plate was 'collected,' or in other words 'fabricated,' and was never exposed for sale." This revelation is probably made on the authority of the shopkeeper in a large way of business who sold the plate, and may be taken as not proven, and valued at what it is worth. But what can be meant by "collect" and "fabricate" as used in the passage quoted? The meaning of the word "collect" most applicable in this case is "to bring together, as separate persons or things, into one body or place." There are several definitions of the word "fabricate;" one is "to form by art or labour," another is "to form or devise falsely, as a story or lie." The fabrics in question were without doubt formed by art and labour and were also indisputably false, but surely Mr. Poole does not mean to say that these are the usual characteristics of "collected" plate; this doctrine would certainly find no favour in the high latitudes of Bond Street and the Haymarket, and notwithstanding the grave air of authority assumed throughout the letter, it can only be looked on as a slip of the pen.

Mr. Poole informs us on the authority of "eminent silversmiths" that in point of fact the consumption of silver, so far from having fallen off, as alleged by Mr. Watherston, has really increased. There is a sudden halt in the statement; they do not venture to say it has increased in the plate manufacture. The Board of Inland Revenue have lately published returns which would at once falsify that; a decrease of over 100,000 ounces in twelve months is one of those stubborn facts which are apt to dry up the ink in a partisan's pen, and the knowledge that a steady increase takes place in the electro-plate and silver jewellery trades which use untaxed material, while it steadily decreases in that branch which uses the tax-burdened silver, is all corroborative of the truth long since announced by economists and now re-echoed by parliamentary committees as an indisputable truism, "that every duty must operate as a fetter upon the manufacture on which it is imposed." But this question has got past the domain of argument; all the good has already been threshed out of it, and there is now little left beyond mere chaff.

No one imagines that fluctuations in the price of silver will ever be entirely prevented by any change in the law, but if you have two industries using up an increasing amount of that metal at the time it is being produced in increased quantities, it surely needs no very profound process of reasoning to come to the conclusion that a third trade also using up an increased quantity would lead us a step nearer to the desired result. The permanent officials of the Board of Trade, whose business it is to make themselves as well acquainted with the laws affecting trade and commerce as it is for Mr. Poole to know how to make a good time-keeping watch, have been most emphatic in their evidence on the point, and it is not difficult to judge which will have most weight in framing future legislative enactments—they, or the officials of the Goldsmiths' Hall.

Mr. Poole promises a future communication on the subject of Trade Marks. In Sheffield we think we know something on that matter, and will be glad to know how Mr. Poole's speculative opinions may square with our experiences. Some of the best trade marks here are much more than a century old, and are valuable assets; yet we are quite open to conviction if better ways can be shown to us—at least that is the feeling of

An Old Hand.

Luminous Paint.—According to an old Chinese encyclopœdia a luminous substance for paint was known and in use in that country more than nine hundred years ago. It is stated that a certain Su Ngoh painted a picture representing an ox, which left the frame in daytime to return at night to sleep. The picture came into the possession of the Emperor Tai Tsung, of the Sung Dynasty (976-998 of present era), who showed it to the mandarins asking for an explanation, which none could give, but a learned Buddhist priest stated that the Japanese prepared a paint from calcined oystershells mixed with sulphur, which had the property of shining at night and be invisible in daytime if painted on a white ground, and thus satisfactorily explained the apparently going and returning of the ox on the picture.—*From* "Die Gartenlaube," *by* H. Bush, Hull.

NEW WINDING MECHANISM FOR GOING BARRELS.

Invented and Patented by E. Wright, Northampton.

PREMISING that the ordinary forms of click-work and stop-work are quite done away with, an opening large enough to admit the box of the barrel is made in the frame-plate, and a disc of steel, attached by a square to the barrel-arbor, is fitted into it. Immediately above and surrounding the opening is placed the ratchet. This resembles the rim of a wheel having teeth upon its *inner* edge, and it is *fixed to the plate.* The opening in the ratchet is somewhat smaller than the opening in the plate, so that when the disc is introduced from beneath, the teeth of the ratchet overlie its edge and prevent it coming through the plate, and when the frame is fastened together, the disc is held flat up under the ratchet by the barrel arbor, and free of the barrel. The disc turns with the barrel arbor, and forms the bearing for that end of it to which it is attached, so that no pivot is required. On the under side of the disc a spiral groove is formed, the number of its turns being equal to the number of revolutions made by the barrel arbor in winding up the spring; and the groove at its inner end terminates in a slot which is cut through the disc near to the barrel arbor. The barrel is fitted with a light steel arm, one end of which is free to move to and fro between the barrel arbor and the periphery of the barrel, and carries a stud which is engaged by the spiral groove. The substance of the disc is partly turned away on its upper side, leaving three studs, upon which are fitted respectively, the click, the stop, and the spring which actuates them.

The stop is a click which acts in the opposite direction to the winding click, and at the part where it is acted on by the spring it is of angular form Λ, so that it is thrown into or out of the ratchet according as the spring rests upon one or other of the inclined planes. It is provided with a stud which goes down through the slot (already described) to the spiral groove on the under side of the disc.

The spring consists of a rigid bar with the thin or elastic portion branching out from its centre. One end of the bar is attached to the disc by the stud previously mentioned, and the end of the elastic part rests on the stop and bears the free end of the bar up upon the winding click.

The three pieces are kept in place by a cover attached in any convenient manner to the disc or to the plate. The ratchet is not necessarily a separate part, as the teeth may, if preferred, be cut direct in the plate.

The action is as follows:—When the barrel-arbor is turned by the key, the click, stop, and spring are carried round on the disc inside the fixed annular ratchet, the stop being held clear of the ratchet, and the click being projected outwardly into it; and each time that the latter rises upon a tooth of the ratchet, it causes the thin end of the spring to slide up the near incline on the stop and approach the apex, or point where the two inclined planes meet. As the winding proceeds, the stud of the barrel arm is carried along the spinal groove, and at the end of it comes into contact with the stud of the stop, and pushing it along the slot causes the apex to move nearer the spring, so that the next time the spring slides up the incline, it passes the point and shoots the stop over into the ratchet, arresting at once the motion of the barrel-arbor.

There is a fixed relation between the click and stop, the one being opposite the teeth of the ratchet when the other is opposite the spaces, and vice versâ; the stop, therefore, always operates at the instant when the click is raised upon a tooth, and as soon as the pressure of the key is removed, the mainspring draws the barrel-arbor backward, causing the stop to rise upon the tooth next behind it, and the click to fall into the space next before it, and the click-spring, following the motion of the click, withdraws again on to the near incline and shoots the stop back into its original position in readiness for the next winding. It will be observed that there are thus two distinct points from which the stop shoots, i.e., one at each end of the traverse of the click-spring; and by this means it is ensured that the stop always goes quite down into the ratchet, and its release is effected without offering any impediment to the running down of the watch. The arrangement occupies no more room in thickness than what is at present in use, and in its simplest form no pins, screws, or fixing are required. The whole strain of the stop is taken by the plate, and no pressure can be put upon the train by the key; whilst owing to the click and its appurtenances being placed *inside* the ratchet, the whole of the winding work can be made larger and stronger than usual in a given limited space.

It may be mentioned that by a simple arrangement of the click, it becomes impossible for the barrel arbor to recoil, or to be turned either way in the event of the click-spring breaking; and also that in case of a recoil of the arbor from any cause, the stop-work sustains no injury, although a stop is provided for the running down of the watch.

In keyless watches the ratchet is cut in or attached to the barrel wheel of the pendant gearing, and is placed around a boss formed on the upper side of the spirally grooved disc. The boss carries a click which is made to engage in the ratchet when the keyless button is turned forward, and the winding proceeds until the click is withdrawn by the action of the barrel arm, leaving the ratchet free to turn round upon the boss. The barrel arbor is held from running back by click-work upon the plate, and as there is no "stop," it is impossible to strain the keyless mechanism. The click upon the boss at all times admits of the keyless button being turned backward, and easy motion in the forward direction indicates that the watch is wound up.

ARGENTINE.

UNDER the above name, Messrs. Constantine and Floyd, wholesale jewellers, of 42, St. Paul's Square, Birmingham, have introduced an excellent preparation for cleaning gold, silver, plated, and gilt jewellery. The sample bottle forwarded to us answers all the advantages which the makers claim for it. After shaking the bottle, a little of the solution is applied with a soft brush to the article to be cleaned, and rinsing in clean cold water finishes the simple process. The removal of all tarnish is instantaneous. It does not destroy the frosted appearance or parcel gilding on new silver goods, and, being non-poisonous, it will prove harmless to children, and no serious consequences would arise to anyone who should mistake Argentine for a liquid requiring internal application. The preparation is sold in white glass-stoppered bottles.

Taxation of Silver Plate.—We are glad to hear that this subject will be brought before the Social Science Association at the Congress shortly to assemble at Edinburgh, by Mr. Edward J. Watherston, the secretary of the economy and trade section, in a paper "On the fluctuations in the relative values of silver and gold, with special regard to the depreciation of silver in India." The author will strongly condemn the duty upon silver manufactures and the laws relating to compulsory hall-marking. The paper, which we shall hope to reproduce in future numbers of this Journal, will probably be taken at 11 a.m. on Tuesday, the 12th inst., Sir U. Kay-Shuttleworth, Bart., presiding.

MACHINE WORK *versus* HAND WORK.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—It is a well-known axiom in mechanics, that what is gained in power is lost in time, and *vice versa*; applying this to watch work, I would say that what is gained in rapidity of production is lost in beauty of finish, etc., etc. A recent conversation with a knight of the needle suggested some practical ideas on the subject. He said that machine work in his own handicraft, of equal quality to hand work, was more expensive, and that cheap machine work was no use at all. This may be readily confirmed by the everyday experience of most of us.

In the watch trade, as may easily be proved by [illegible] to the price lists of the American Watch Company, the [illegible] of best machine made movements are considerably more expensive than our own. The extra work is given in the extra polish of the steel work, gold settings to jewellings, gold wheels, and elaborate arrangements for adjusting the indexes. A watch with fusee and chain could not be constructed by machinery, neither could a chronometer escapement. The manufacture of watches by machinery can only be carried on on a very large scale; in point of fact the chief feature lies in the movements, which are strictly made to a gauge, thereby enabling the various parts to be interchangeable. A great feature is made of this latter point, but as a practical man I have grave doubts of its real utility. Under any circumstances an amount of skilled hand work is required to supplement the productions of the machinery. The following quotation from a letter written by the practical representative of one of the oldest established watchmaking businesses in America is quite *apropos* to the present topic. Speaking of the watch factories, he says:—"The trouble with those here is that they are entirely in the hands of business machinists whose interests are of course to keep the business as far as possible in their own hands. We have long thought that the best results would be obtained only when machine work is supplemented by skilled hand work."

In order to keep up the supply of this skilled hand work, a special training is required, and I propose to go back some twenty-five years and detail some of the methods by which the art and mystery of watchmaking was inducted into young beginners, taking the lever escapement as the illustration.

In those days and previously, elaborate tools were very little used; the old legend of a "nail and piece of cork" had more significance then than now. Just as our young seamen are supposed to be better trained in sailing vessels than steamers, even at the risk of going to the bottom, as in the cases of the "Eurydice" and "Atalanta," so young beginners were taught to depend upon their own ingenuity for many of the methods they employed in doing their work. By so doing the delicate and skilful touch was acquired which enabled them to become thoroughly conversant with the properties of the materials on which they were working. While I write I have before me a gold pocket chronometer made by my grandfather sixty years ago, which is in perfect condition and contains all its original parts, including the mainspring.

Let us now suppose the young beginner commencing his first task, which in my experience was to whet up a graver, a task, simple as it seems, requiring much skill. This had the effect of hardening and strengthening the fore finger so as to lead up to the next operation—viz., sawing pieces off a circular piece of brass to make ferrules. The use of the file was previously acquired by filing the end of the brass perfectly true; by this means the eye and hand were trained to act in unison. No one was allowed to proceed with any operation for which a good foundation had not been previously laid. When a certain amount of proficiency had been attained in sawing off these pieces, they were then hammered on an old flat iron, minus the handle, which was placed between the knees, and many painful concussions were experienced during the operation. The next process was drilling. The hole was directed to be made exactly in the centre and quite straight, so as not to depend upon the assistance of the brooch afterwards. Now followed the turning, the brass was placed on an arbor, and a true circle struck round the outside edge, which was filed up to in the vice, great care being taken to keep the edge square and to avoid injuring the circle. The great difficulty with beginners is to keep the graver from "following up," in other words, they touch the brass all over before it is true, and an experienced teacher could always detect this by the sound. It is also necessary to keep the arbor tight in the turns, with only sufficient freedom to allow it to move easily. The squareness of the sides were tested by holding the ferrule up horizontally and placing the edge of the graver over them, and no work was "passed" unless the graver was in good condition, otherwise, and very properly, the result was set down to chance. The groove in the ferrule was another point requiring special attention; filing was discouraged, and by this means a general command was acquired over the graver.

The foregoing details may seen trivial, but just as in the squad drill of a recruit lie the principles of the movements of an army in the field, so it is necessary to be thoroughly well grounded in these first principles of filing and turning.

It is needless to say that the instruction was carried on by interested persons, as no ordinary workman would take the trouble. A certain amount of proficiency having been attained in working in brass, steel was then attempted. Square pieces were cut off sheet steel, all "slipping" being discouraged, and then filed circular before turning.

At this stage the making of drills was introduced, and the neophyte would have the pride of using one of his own ferrules.

The steel was carefully filed eight square to fit the ferrule, and great care taken with the tapering down of the part which was beaten out to form the drill. In short, no makeshift contrivances of any kind were allowed to be used.

James U. Poole.

(*To be continued.*)

BOOK NOTICE.

The Watch and Clock Trades Directory. Third edition. Kelly & Co. London, 1880.

The trade is well acquainted with the two previous editions of this indispensable work, and we need only call attention to the fact that a third edition, revised to date, is now ready. The same care which Messrs. Kelly & Co. bestow on all their other directories has been applied to the present one, and its usefulness has been increased by the addition of the names of the members of these trades in the principal towns of Ireland.

Gilding Solution.—The following gilding solution, to be used at a temperature of from 120 to 180° F., has been recommended by M. E. Rod in *Le Monde de la Science*: Crystallised phosphate of soda parts by weight, 60; bisulphide of soda, 10; cyanine of potassium, 1; chloride of gold, 2·5; distilled or rain water, 1,000. To prepare this bath properly the water should be divided into three portions, viz., one of 700 parts and two of 150 parts by weight. The sodic phosphate is dissolved in the first portion, the chloride of gold in the second, and the bisulphide of soda and cyanide of potassium in the third. The two first portions are gradually mixed together, and the third is afterwards added. With this solution, M. Rod uses a platinum anode—a wire or strip—adding fresh portions of the gold salt as the solution becomes exhausted.

A FEW WORDS ON GEMS AND PRECIOUS STONES.

By Edward J. Watherston, F.S.S.

(*Continued from page* 30.)

The ancients, being unacquainted with the refraction of light, did not cut their stones in the form now called "brilliant cut," which was an invention of a diamond polisher of Bruges, A.D. 1456. The invention known as "double cutting" is of more modern date, it having been discovered by one Vincenti Peruzzi towards the end of the 17th century. It is interesting to note that the practice of setting stones transparently (*à jour*), is of recent date. Madame D'Arblay, in her novel of "Evelina," mentions the fact of her heroine being the first lady appearing in society with a diamond necklace so set, "causing astonishment and admiration." Ninety years, therefore, can only have passed since its introduction.

In the list of celebrated diamonds known to exist at present, the one called the "Braganza," in the possession of the crown of Portugal, is generally set down as the first, being by far the largest stone ever found. But much doubt hangs over the fact whether the "Braganza" is a diamond at all. It has never been cut, and a few favoured persons who have been allowed to handle it—the Portuguese Government guarding it with the most jealous care, confining it like a State prisoner—have given their opinion that it is nothing more nor less than a white topaz. The "Braganza," taken from a Brazilian mine in 1741, is of the size of a hen's egg, slightly concave on one side, and of yellowish colour. Its weight, in the rough state in which it still exists is 1,680 carats. With becoming modesty, the Portuguese Government has fixed the value of the "Braganza" at 267,075,000 milreis, being upwards of 58 millions sterling. It is just ten times the annual revenue of the kingdom of Portugal, and, perhaps, the Government might be willing to sell the "Braganza" at the appraised value, when the happy purchaser might carry away his fifty-eight millions worth of goods in his waistcoat pocket.

Second in rank to the "Braganza," being considerably less than one-fourth of its weight, but standing first on the list of undisputed diamonds, is the "Mattan." It was found at Landak, Borneo, in 1787, and belongs to the immensely wealthly Rajah of Mattan, forming the most precious heirloom in his collection of gems. The stone is pear-shaped, with a small crevice at the narrow end, and in its uncut state weighs 367 carats. Sanguinary battles have been fought for the possession of the "Mattan." A Dutch Governor of Batavia, on one occasion, offered not only an immense sum, reported to amount to half-a-million sterling, but, besides, two fully-equipped men-of-war for the "Mattan," yet meeting with a blank refusal. The ground of it, given by the Rajah, was that his diamond was "a talisman, upon the possession of which depended not only his own happiness and success, but that of his whole family."

The next largest known diamond is the "Nizam," belonging to the Indian potentate of that title. It has, however, but rarely been looked at by European eyes, though its existence appears to admit of no doubt. It was found in the famous diamond mines of Golconda, Hyderabad; and uncut, like all the largest diamonds, weighs 340 carats. There is said to be a stone of much larger size than the "Nizam," to which the name of the "Agrah" has been given, in the possession of one of the native Indian Princes, but its existence is problematical, or at least it is very doubtful whether it is a diamond. The French traveller, Tavernier, who visited India towards the middle of the seventeenth century, mentions the "Agrah" in his "Voyages," and is the sole eyewitness of its then existence. Nothing has been heard of the "Agrah" since it was seen by Tavernier.

The "Nizam" closes the list of existing diamonds weighing over 300 carats. Of between 200 and 300 carats weight there are, or rather were, only two diamonds, one of them doubtful, only known upon the report of Tavernier, who named it, from its shape, the "Great Table," stating its weight at 282 carats. The other stone, bearing the title of the "Great Mogul," from its former ownership, has its authenticity fully established, although it does no more exist in its old form. Not only Tavernier but many other European travellers saw and examined the "Great Mogul," originally at Delhi, among the crown jewels of the Mogul dynasty, and subsequently, by right of conquest, in the possession of Mahommed Shaw, great-grandson of Aurungzebe, and of Nadir Shah. In its original rough state the "Great Mogul" is said to have weighed no less than 787 carats; but one of its owners, Shah Jehan, was induced to entrust it to a Venetian lapidary, Hortensio Borgia, in order to cut and polish it—of course, under his own eyes—in the palace of Delhi. Being apparently not very skilful in the splitting of diamonds, Borgia cut the magnificent stone down to 280 carats, or not much more than one-third of its former weight, shaping it in the form known as a "rose." But the rose, not being very beautiful, had to undergo in after years further transformation, which brought it down to one-seventh of its original weight. This last change was effected among us—the "Great Mogul" being no other than the well-known "Koh-i-noor," or "Mountain of Light," which figured in the London Universal Exhibition of 1851, and is now the most precious jewel in the regalia of the English crown. Some writers on gems appear sceptical on the subject of the "Great Mogul" and the "Koh-i-noor" being one and the same stone, but there can be no reasonable doubt as to the fact, since the genealogy of this diamond has been almost more distinctly investigated than that of any other. With successive Asiatic princes and warriors, it went from Delhi to Cabul, to Cashmere, and to Lahore, till taken possession of, at the Treasury of Lahore, by the East India Company, the "ancient gentlemen of Leadenhall Street" deeming it fair booty in return for having installed the boy Dhulip Sing as nominal Rajah of Lahore. But the Indian and English Press declaring against the easy appropriation of so costly a "bauble," the Leadenhall gentlemen thought fit to perform a splendid feat of liberality by presenting it to the English crown. The Governor-General of India, Lord Dalhousie, was instructed to send the gem to England in special charge of two officers of high rank, who solemnly presented it to Queen Victoria on the 3rd of June, 1850. According to Indian superstition, the possession of the "Great Mogul" brought not only not good fortune but always ill luck. The stone itself was decidedly unlucky by being cut down from its original 786 carats to the comparatively small size of 102 carats, in the shape of a "brilliant" shining in the crown of the Queen of Great Britain and Empress of India.

Preceding the "Koh-i-noor" in its present form, in size and weight, are three other diamonds, known as the "Regent," the "Orloff," and the "Star of the South." The history of the "Regent," also called the "Pitt," from its first European possessor, is somewhat curious. This stone was found at the Putcal mines, India, by a slave, weighing in its rough state 410 carats. The slave, to hide the treasure, cut a hole in his thigh, and let the skin grow over it, but was so foolish as to confide the secret to an English skipper, master of a vessel in which he fled, who cut off the leg, took out the diamond, and then threw the owner overboard.

(*To be continued.*)

THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.*

By M. Grossmann, Watch Manufacturer,
Glashuette (Saxony).

(*Continued from page* 31.)

47. The omission of the stop-work has been tried in a manifold way. It is more than twenty years since a spring was suggested for this purpose, to the outer end of which was riveted a piece of the same spring, of a length equal to about one-third of the inner diameter of the barrel.

This piece was fixed backward in the direction of the spring, and its free end was resting against a hook in the barrel of the ordinary shape. This arrangement allows the spring to be coiled up to its outermost extremity, and the short piece riveted to it will then rest in an oblique direction against the hook, and prevent any farther winding (Fig. 16).

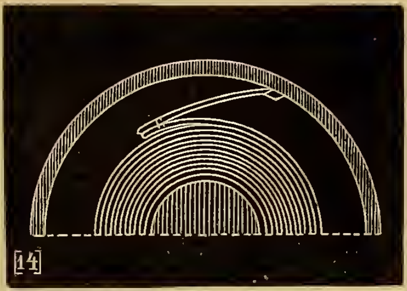

Fig. 16.

This system is superior to the simple omission of the stop-work, because it preserves the spring much more against breaking; but it does not protect the other parts of the movement from the sudden strains resulting from inconsiderate winding; a fault, though, which may be urged against any of the kinds of stopwork hitherto referred to.

This arrangement looks rather primitive, but it ought not to be totally rejected. I was desirous of obtaining a correct idea of its merits, and constructed about twenty years ago two small ladies' watches, which had to be very flat, with barrels of this kind. These watches have been kept in constant use by persons in my immediate neighbourhood, and thus I have had them under constant observation all this time; they gave satisfaction as to the rate of going, and none of the springs have been broken up to the present time.

Some years ago I saw some watches of American origin, the barrels of which were arranged in quite a similar way, with the only difference that the piece riveted to the end of the spring had two pivots at its free end, the one of which moved in a hole through the bottom of the barrel, and the other in the same way was held in the barrel cover.

48. More than ten years ago a system was invented by which the weak points of the one just mentioned are avoided, and the stop-work entirely dispensed with. These are the *free springs* of Mr. A Philippe. An examination of their advantages, and of the objections raised against them, will not be out of place here.

These free springs are made or arranged in such a way as to take their hold in the barrel without the usual hook, merely by the greater tension and strength of their outer coil, which, for this purpose, is about double the thickness of the acting part of the spring. The relative thickness of these two parts must be kept in such proportion that the outer coil, always keeping a frictional hold in the barrel, follows the winding movement, but only when the spring has attained a certain maximum of tension. Thus, any tension of the spring beyond this maximum is rendered impossible, if the winding is continued ever so long.

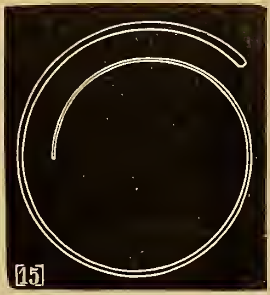

Fig. 17.

49. The springs of this kind have been, and may be executed, in two different ways. According to the one, the thicker part is a part of the spring itself; while the other way consists in adding to a spring of the usual kind a separate piece of greater strength, equalling in length the inner periphery of the barrel, and forming as it were, an elastic bridle for the main-spring, which is attached to it by a hook.

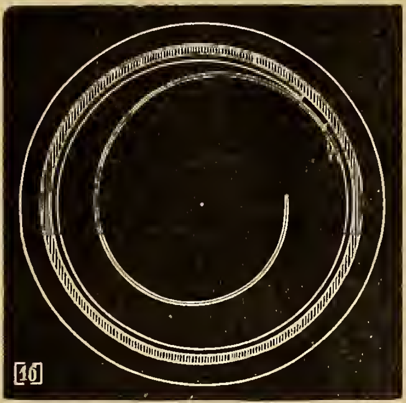

Fig. 18.

The effect of the two dispositions is, of course, the same.

50. It is not easy to pronounce briefly an opinion for or against the free spring; for, judging equitably its merits, we have to consider its drawbacks and the objections raised against it by watchmakers and repairers, and balance them against the advantages it promises. These latter are:—

(1.) Greater height of barrel, allowing to employ for a watch of the same size a broader and thinner mainspring, which is consequently less exposed to accidents, and gives a more uniform traction. (2.) Economy in the manufacturing of the barrel. This advantage is, however, in a degree absorbed by the higher price of the free spring, but this price will be considerably reduced if the free spring should become a regular article of trade. (3.) Complete elimination of all derangements of the watch resulting from defects or disorders of the stopwork. (4.) Protection of the movement against all injury arising from inconsiderate and rough winding. (5.) Lengthened period of daily march with once winding, because the free springs generally are made so as to admit a tension of six turns or more. These advantages, especially those from 3 to 5, are of great importance, and No. 4 in particular has not yet been so much appreciated as it might be.

QUERIES AND ANSWERS.

Electro-Gilding.—Will you or some of your numerous readers inform me of a simple method whereby I may give to jewellery, etc., a deeper colouring than is obtained by using the ordinary sovereign gold.—*Deep Tint.*

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BRONZES.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 143, *Vol.* V.)

ART had steadily declined in Greece and her colonies before their final conquest by Rome. The original religious feeling, the desire to represent to the senses the ideal creation of the intellect, had been satisfied, and could not be surpassed without a new inspiration; a realistic sentiment naturally followed, and, by the impersonation in marble or in bronze of those forms of the beautiful human figure which they knew so well, art was gratified for the while, and the less intellectual and more sensuous eye was pleased, but soon to satiety. The higher intellect roamed among philosophic dreams which she could not embody.

Novius Plautius was a Roman sculptor who worked about 250 B.C. His name is incised upon a little group representing a youth and two satyrs, which forms the handle to the celebrated cista in the museum of the Jesuit College at Rome. In workmanship it is very inferior to the admirable engraving on the body of the cista. The name of Publius Cincius Salvius is inscribed on the huge bronze pine cone which formerly surmounted the mole of Hadrian. Titius Gensellus modelled his own bust. Flavius Largonius made statuettes, and Copronius fourteen figures to represent nations conquered by Pompey. Decius cast a colossal head for the consul Publius Lentulus Spinther (B.C. 56). Until about 190 B.C. nearly all the important temple statues at Rome were of bronze. An art more purely Roman displayed itself after the period of Augustus, when it became more and more subject to mere architectural decoration and portraiture.

Of antique and fine workmanship worthy of that age are the four noble gilt bronze fluted columns of the Corinthian order, which now adorn the chapel of the Holy Sacrament in the lateran basilica. The massive bronze doors of the Pantheon are still *in situ*. A bronze sculptor named Lenodorus was celebrated, in Nero's time, who formed a colossal figure of that emperor 115 feet high; but the power to produce such large works was already feeble, for, notwithstanding the emperor's readiness to find the richest material, Pliny informs us that the figure indicated that the art of casting statues of that size was lost. The huge head of Nero, in the court of the Capitol at Rome, is supposed by some to be a portion of this figure, but Lenodorus can hardly have been guilty of such inferior modelling. Sculpture had still further and rapidly declined from the period of Nero to that of Trajan, although there is excellent work upon the bas-reliefs of sarcophagi and buildings of the latter reign. The gilt bronze figure of the youthful Hercules in the Capitol is probably a Roman work of the decline.

Another revival occurred at the period of Hadrian (A.D. 117-138), that emperor giving great encouragement to the arts and endeavouring to revive the Hellenic spirit of a former time. But it did little more than reproduce earlier and better works, and by their study induced a spirit of eclecticism rather than the fire of originality. This is shown in the otherwise beautiful marble figure of Antinous in the Capitoline museum. The greater number of the more important works in marble and bronze which have descended to our time, excepting those of which Pompeii and Herculaneum have yielded so rich a store, were probably produced during this period of revival. In some instances these are original, but for the most part are copies in various sizes of the works of the great Grecian sculptors, several of which we have already referred to. A statue of note and rarity also, by some attributed to this time, is the huge and heavy gilt bronze Hercules recently found in Rome, and now placed in the Vatican. It may, however, be of earlier date.

The splendid centaurs of the Capitol, in black marble, by Aristeas and Papias, of Aphrodisias, sculptors of Asia Minor, are also works of this period, and supposed to have been copied from earlier bronze originals. An admirable reduced copy of one of these, believed to be from the *atelier* of John of Bologna, is in the writer's collection. Other works of the period are the faun of *rosso antico*, in the same Roman museum; the dancing faun, and hermaphrodite in marble. But few large works in bronze are preserved to us. Many smaller works in that metal, beautifully modelled, carefully cast, and excellently finished in the details, may also with probability be attributed to this Antonine Græco-Roman revival.

The equestrian statue of M. Aurelius on the Capitol is a Roman work, and important as the only antique equestrian statue in this material which has been preserved to our days, a fact owing, it is said, to a belief among the iconoclastic Christians of succeeding time that it represented the first Christian emperor, Constantine. Later and painfully inferior is the colossal bronze statue of Theodosius at Barletta, a work of the end of the fourth century.

Probably the most meritorious works of the third century are the reliefs upon the sepulchral sarcophagi so much in use at the time of the Antonines, some of which are of great beauty. That in the Capitoline museum, which was supposed to be the tomb of Alexander Severus, and in which the celebrated Portlam vase of glass was discovered, may be instanced as an example of true excellence and in the highest *rilievo*. Many of these have Christian subjects and allusions intermingled with allegorical representations of Grecian mythology. Numerous are the smaller figures and ornamental objects in bronze, the work of these centuries of the final decline of classic taste. Many of them, derived from models of preceding time, nevertheless perpetuate the forms of higher inspiration, and a certain character of expression and style of workmanship although rude still convey the reminiscence of a former vigour, they are the spasmodic efforts of a decrepit and decaying art.

We have already stated that the earliest figures of a large size were formed of beaten plates (*sphyrelata*) attached to a wooden core by pins. The art of beating from behind and thus producing *rilievos* of mere ornament or of subjects is also of the highest antiquity, and probably preceded the knowledge of casting. These reliefs (*emblemata*) were formed either by simple action of the hammer working from behind, and afterwards sharpening the outlines by the chisel or punch, or by beating the metal plate into a mould previously formed by carving the subject in intaglio upon some resisting material. Both methods were applied to produce a vast number of objects in the precious metals and in bronze, and particularly for the ornamentation of objects for sacred and domestic use, as vases, cups, &c.

The British Museum is rich in fine examples of beaten work of the good period of Grecian art. We may particularly refer to the two ornaments which once covered the shoulder buckles of a cuirass and back-plate, known as the "bronzes of Siris." These are ascribed to some artists of the school of Scopas, and are marvels of breadth in style combined with minute execution. The British Museum also possesses many admirable mirror cases in silver and in bronze. We have already referred to etruscan works in the same collection.

As examples of the perfection attained in this class of workmanship, although not of bronze, we may instance the silver cup in the Corsini Palace at Rome; the centaur and ivy leaf cups and the vase with apotheosis of Homer in the museum at Naples; the superb objects in silver discovered at Hildesheim in 1867, and now in the Berlin Museum, of which reproductions are in the South Kensington collection; a silver drinking cup of extraordinary beauty, undoubtedly of Greek work, and worthy of the period of Lysippus, though probably of later date, belonging to Sir William Drake; the

Aquileia goblet at Vienna; the Bernay treasure; and, though of minor importance, a silver cup, adorned with sycamore leaves, in the writer's possession. The museum at Naples is, perhaps, the richest in bronze objects for domestic use, many of which are of great artistic beauty; some are executed by beaten work, others cast; others, again, by a combination of the two methods—the body of the vessel beaten, with handles, feet, etc., cast in the round (epithema), and rivetted or soldered on. Among the more important collections of antique works of sculpture, etc., in bronze, may be mentioned—in Italy, the Museo Nationale at Naples; at Rome, the Vatican, the Capitol, and Kircherian Museum; at Florence, in the Uffizii, Perugia, Cortona, Volterra; the bronze horses at Venice; the Victory at Brescia. In France, at Paris, in the Louvre, and the Bibliotheque, and in the local public museums at Nismes, Arles, and other cities. In Germany, besides the important public and royal collections at Berlin, Vienna, and Munich, many interesting bronzes, some of which we have already mentioned, are scattered among the local city museums, as at Hanover, Brunswick, etc. In Switzerland, at Berne and Zurich. In Russia, at the Imperial Museum, in St. Petersburg, where is also the private collection of Count Stroganoff. In Holland, at Leyden. Few or none, however, out of Italy can compete with our own national collection at the British Museum, where are many works already referred to in these pages, and where the art of working in bronze is well represented from the most archaic period to the decline; following upon this is the South Kensington collection of objects of the mediæval and *renaissance* times.

HINTS TO REPAIRERS.

(*Continued from page* 28.)

THERE are a few items that we wish to direct special attention to. Be sure that the arbors in the barrels are oiled, and that the main-springs are hooked before you put them in the frame, and be sure there is oil on the pivots below the winding ratchets before they are put on, and that the wheel that carries the minute hand moves round the centre pinion with the proper tension, before you put on the dial. After the dial is put on this cannot be remedied without taking it off again, and if the hands are loose, results fatal to the character of the clock are sure to follow. We can recall an instance where a customer left an order at a celebrated watchmaker's to have a French clock put in order. One of the workmen, who had the name of being a good watchmaker, was sent to examine the clock, and he brought it away, cleaned it, and took it home again. For months complaints came in that the clock went slow, and the man who cleaned it always went and altered the regulator, but with no good result, and the clock was a second time brought to the shop. It was examined, and the small wheel on the top of the regulator was found to have been wrenched off. The regulator was a Breguet one, and when the piece that slides on the pendulum spring was raised as far as it could go, of course any further turning of the regulator square at the point of the dial wrenched the wheel off, as we have stated. Now the real cause of all this trouble and annoyance to everyone concerned, was nothing more nor less than the hands were loose in some positions in which they were set, and when the clock was in the act of discharging the striking part every half hour, the hands sometimes fell back a little, and the clock appeared to be going slow.

In regulating one of these clocks, especially if you have to go a distance to do it, and are not conversant with all its peculiarities, it is always safest to turn the case round, examine the regulator, and if it is a Breguet one, put a slight mark with a sharp point across the regulator, and when the regulating square is turned you will see exactly how much the regulator is altered, because there is sometimes a want of truth in the screw that moves the sliding piece, which deceives people as to the value of the amount they may have moved the regulator. There are various kinds of regulators, but probably the Breguet one is the most common of those of modern construction. Those that have silken thread regulators should always be regulated with caution, and when small alterations have to be made, it is well to use an eye-glass and notice how much the pendulum is moved up or down.

When a clock with such a regulator has to be moved or carried about out of the case, it is always safe to mark the place where the pendulum worked in the back fork when it was regulated to time; for, should the thread be disarranged it can be adjusted so as to bring the mark on the pendulum to its proper place, and the regulation of the clock will not be lost thereby.

On fastening one of these clocks in its case, they are generally put in beat by moving the dial round a little till the beats become equal; but it sometimes occurs that when the clock is in beat, the dial is not square in the case. When this happens, it is always best to take the clock out of the case and bend the back fork *at its neck* till you get it to move exactly as far past the centre wheel pivot on the one side as on the other, when the pallets allow the scape wheel to escape. If this is done, the dial will be square when the clock is in beat. Some French clocks have their back forks loose, or rather spring tight, on their arbors. This is sometimes done in movements that have plain as well as jewelled pallets. If the pallets are exposed in front of the dial, you can at once detect by the eye if the clock be out of beat; but if they are inside, you cannot tell without close listening. One of the objects of the loose crutch spoken of is that the clock can be put in beat by giving it a shake; but it is evident that if a shake put it in beat, another shake will put it out of beat again. We have seen great annoyance arise from these loose crutches, and long journeys made to examine clocks when nothing was the matter with them more than they were out of beat, caused by the housemaids moving them in their dusting operations. The crutches ought always to be rigidly tight, except, perhaps, when the pallets are jewelled, and the clock not liable to be moved.

As to cleaning these clocks there remains but little to say; they seldom, if ever, require any repair, except, perhaps, the pallets get cut, but they are generally made so as to admit of the action being shifted, and this is easily done. Cleaning the brass, of course, is done in the usual way. Buffs should be used for the large pieces when very dirty; but if they are only slightly tarnished a little cyanide of potassium dissolved in alcohol will be found very suitable. The cases require to be handled with care, and special care should always be taken to prevent finger marks. In the very highest priced clocks this precaution is perhaps not quite so necessary, because then the cases are either real bronze, or gilt and burnished; but in the cheaper qualities, and also in some expensive patterns of cases, the gilding is easily damaged. A little cyanide of potassium and ammonia dissolved in water will often clean and restore it if the gilding is not rubbed. There is a preparation sold in the form of a paste that renews the lustre of black marble cases if they have become dim. If the preparation is not at hand, use a little beeswax on a piece of flannel. Although we have known some instances where there was much trouble and little satisfaction in the going of newly imported French clocks, in almost every instance the trouble could be traced to the mismanagement of the persons intrusted to put them in order and adjust them. A little care, and the exercise of sound judgment on the part of the workmen would prevent many annoyances that sometimes happen with pendulum French clocks.

(*To be continued.*)

THE ART OF THE SILVERSMITH.

By W. Herbert Singer.

(Continued from page 21.)

THERE are but few specimens of fifteenth century silver work left to us, the ecclesiastical plate with but very few exceptions having disappeared at the Reformation, and most of the plate in the hands of the rich nobles and commoners having been melted up during the civil wars. But, although the originals have long been lost, there are numerous dispositions of these former riches to be found in mediæval wills, from which we learn that many of the feudal lords were possessed of great riches in gold and silver plates, both for ecclesiastical and domestic purposes. The merchant princes of the fifteenth century also had their treasuries well stocked with silver plate. Some of the London guilds, and colleges in Oxford and Cambridge, possess specimens of the latter end of this century, but they are probably not examples of the best work of the age.

The village of Nettlecombe, in Somersetshire, has in its Church a pre-Reformation chalice and paten. The chalice is very beautiful in its proportions, and has served as a model for many of those produced in modern times. It stands nearly six inches high. The bowl at the lower part is broad, with the sides conical. The hexagonal stem is divided into two parts by the knob, which is an excellent piece of work. At the projection of each of the arms, forming this member, is a leopard's head, the spaces between being ornamented with pierced work. The base is divided into six compartments, and in one of these is an engraved plate, upon which traces of enamel are still visible, the subject being that of the crucifixion. We owe our knowledge of this chalice and paten to Mr. Octavius Morgan. They are of great interest, not only on account of their beauty, but also from their antiquity, for they are almost the oldest examples of hall-marked English plate known.

It was during the reign of Edward III. that the workers in the precious metals had granted them their first charter of incorporation, and in 1462 they were formed into a regular company, with the power to inspect and stamp all gold and silver work produced in this country.

The Romanesque style took deeper root in Germany than in any other country of Europe, for we find that the Germans continued to produce work in that style longer than any of the other nations. But, when the older forms gave way to the newer ones of Gothic art, a very beautiful style was developed, which was most perfect, during the thirteenth century. One of the best specimens of this period is the shrine of the Great Relics, in the treasury of Aix-la-Chapelle. Its general form retains the old outline, but we see a great difference in the character of the ornamentation. The foliage upon the ridge of the pointed roof is most beautiful in design and execution.

Another specimen, dating from the early part of the thirteenth century, is the shrine of the Three Kings, at Cologne; in this there are more traces of the Romanesque style than in the example before mentioned. As the century grew older, these large objects became more scarce, and in their place a reliquary was made to contain only a part of the departed saint, and its form partook of the shape of the member which it contained. The next change in German art was commenced by the artists of Augsburg and Nuremberg, and although it lacked much of the grace and refinement of the previous period, it was a style well adapted for the production of works in the precious metals.

The condition of Italy, at the beginning of the thirteenth century, was particularly favourable to the cultivation and development of the fine arts. Comparative peace was now established between the many small but wealthy States, into which this kingdom was then divided. At the head of each was an independent prince, and as these rulers had no longer to vie with one another as to who should be chief in battle, each strove for the State he governed to produce the finest works of art. The silversmith's art was in especial demand, it being here held in greater estimation than in any other part of Europe, thus gaining for those who produced such work a higher social position, thus accounting in a great measure for the rapid improvement that was now made in this artistic land.

At first the workers in silver were pupil is of sculptors. Of them they learnt design and composition, but many of the apprentices soon excelled their masters, and a few years later we find that most of the great sculptors commenced their career in the workshops of a silversmith. Thus, again, the arts of sculpture and silver-working are brought together.

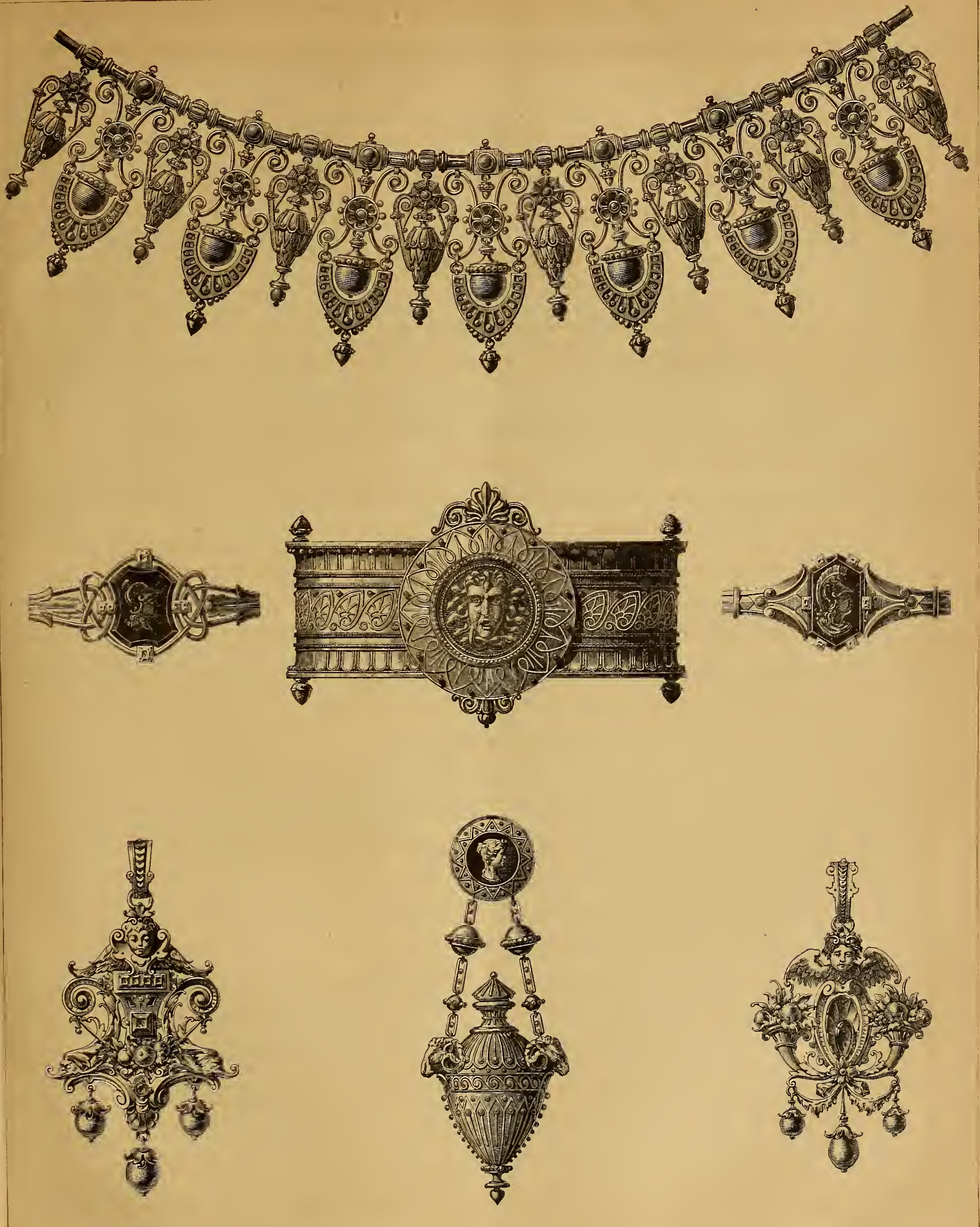
It was only during the thirteenth century that Gothic art held its sway in this land, but during that time many great works were created. It will be impossible to give more than a rapid glance at this bright epoch in the history of the silversmith's art. As an example of the universal excellence of the work now produced in Italy, I cannot do better than describe the chalice of this period. The bowl is most elegant in shape, the sides forming a graceful curve; round the lower part is often a little ornament in enamel. The knop, although an important part of the whole, is subordinate to the bowl and base, and was treated accordingly. The work upon it was generally in enamel, each colour being contained in a simple, but effective form. The stem is hexagonal, and is either decorated with a pattern in niello or enamel, or divided into little compartments with a deep edge, which produces effect by its shadow. The base is the member which gave the artist the greatest scope for displaying his skill, and he took advantage of it to the utmost. It was usually divided into six or eight lobes, and upon these were represented various subjects in enamel or neillo, and although the figures were so small, they were admirably composed and drawn, the border of each division being richly ornamented with a minute pattern, and the part of the base between that upon which the subjects were executed, being covered with a beautiful design in low relief.

The Church now had command of enormous revenues, and it was in costly metal work that the best means were found of investing its surplus funds. This accounts for the numerous and costly altar frontals which were made during the Middle Ages for the cathedrals of Italy. Upon them the greatest artists worked, and they are worthy illustrations of the wonderful skill of the Italian silversmiths.

The fifteenth century in Italy is chiefly remarkable for the works in bronze that were then created. It is at once noticeable to every student of art history that gold first claims the attention of a nation when in the infancy of art. Silver is next used as a medium in which to express their ideas of beauty. When their art is freely developed, the precious metals are, of course, still used in their proper sphere; but we also find that the baser metals, and especially bronze, is much employed, as in that material the artist can carry out ideas that would be impossible in the more costly metals. Now, instead of town striving against town, as to which should possess the most massive object in gold or silver, we find one endeavouring to outbid the other, to secure the services of the most skilful artist of the day to execute, perhaps, some small, but perfect piece of work.

From the middle of the thirteenth century to the termination of the fifteenth, the metal work created by the Italian artists was of the greatest beauty; the forms were then both pure and correct, and it was the study of ancient art that brought about this splendid result.

(To be continued.)



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THE
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W.H. TILBY

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

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CONTENTS.

	PAGE
The Time Work and Time Signals of the Greenwich Royal Observatory	47
City and Guilds of London Institute ..	48
Turners' Company's Prizes	48
Queries and Answers	48
Practical Instructions to Jewellers, Silversmiths and Electro-platers	49
The Latest Fashion in Jewellery	49
Repairing Swiss Watches	50
Art Work in the Precious Metals	51
Property of the Guilds of the City of London	51
Trade Catalogue	51
Hall-Marking..	52
Hall-Marking in America	52
Machine Work *versus* Hand Work	53
Müller's Patent Chronometer Escapement	53
On the Fluctuations in the Relative Values of Silver and Gold, with Special Regard to the Present Depreciation of Silver in India	54
The "Defiance" Press	54
The Construction of a Simple but Mechanically Perfect Watch	55
Technical Instruction to Watch and Clockmakers..	56
British Horological Institute	57
The Art of the Silversmith	58
Patents	i
Monthly Record of Bankruptcies	ii
Directory	iv
Advertisements	i—xii

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THE TIME WORK AND TIME SIGNALS OF THE GREENWICH ROYAL OBSERVATORY.

By C. Stuart Murray.

(*Concluded from page* 36.)

HAVING now got the mean solar standard to correct mean time we are ready and waiting for ten o'clock in order to send the first signal of the day. This sending is managed by the clock itself through the electric wire relays. It is done by a pin on a small arm that is fixed to the arbour of the seconds wheel, and by another upon that of the minute-hand spindle. Each pin has to act upon a pair of very fine springs which are in contact with the sending wire. The seconds hand pair of springs closes the circuit at the O of every minute, whilst the minute pair are only closed between the 59½ and the 60½ in each hour. Let us say that the 59½ of the last minute has been reached, then the hour circuit springs are closed and will pass any current that comes along their wires up to the 60½ minute, when they will be reopened by the passing away from them of the pressure of the pin on the arbour of the minutes-hand wheel. But watching the seconds hand during this time, we see that it is rising to the top with every beat of the clock. Finally it reaches the 60th second, when its pin instantly closes its circuit, and the hour circuit being already closed, as has just been stated, away goes that 60th second up to London, and before the 61st has been reached Greenwich mean time is known all over the country! And that is how time is made at Greenwich. Is it not a triumph and a wonder? Just consider what timekeeping is to what timekeeping was. It is known both to astronomers and scientific horologists that in no astronomical observation cited by Ptolemy is the time indicated *nearer* than a quarter of an hour. We are not satisfied with anything less than seconds, and even tenths of seconds, in our clocks.

And thus it goes on every hour of the day and every hour of the night throughout the lengthened year.

But we must not omit the great time-ball that gives its signal to the chronometers of the shipping on the Thames, and also to the surrounding neighbourhood. The ball is fixed to the top of a rod that works in a groove of the mast on the east turret of the Observatory. As this ball is the first of its kind that was erected, as may be expected the mode of hoisting is in keeping with its date. We went into the turret, and saw that it was raised by a winch and chain. The deal ball, and others that have been since put up, are raised by means of rack and pinion work, a far more suitable way. The lower end of this rod terminates in a piston, resting at the bottom of an iron cylinder. There are a couple of guide rods having a collar sliding easily upon them, the latter being attached to the end of the winch chain; this collar "takes in" with another, which is fixed to the rod of the ball itself. When the ball is wound up there is a contrivance for keeping it in its place, whilst the chain is unwound and the collar that raised the ball returns to its place below. The ball is let go at the hour of 1 p.m. by the standard solar mean clock. In connection with the closing of the electric circuit by the clock which has been already described is an armature acting upon a detent or trigger, to which levers are attached As in other cases, when the 60th second of the hour has been reached, the electric current from the clock releases the trigger, and the ball descends. The deal time-ball does so at the same instant, whilst guns fire at different places. When the deal ball falls it sends a return current to Greenwich to say that all is right. When that is not so a signal is sent by hand. The cylinder and piston at the bottom of the ball rod are to prevent violence from the fall by using the air in the cylinder as a cushion. Should the ball not act at the proper time, it is lowered to signify that fact, and again hoisted for 2 o'clock, when it is let down by hand. The time of hoisting it every day is five minutes to one o'clock, and it falls exactly at one. The hour signals for London pass through the signal relays of the Post Office, St. Martins-le-Grand. There is an arrangement by which public clocks can report themselves to Greenwich, and obtain an answer, but at present "Big Ben" of Westminster is the only one that does this. The country signals go out at 10 a.m. and 1 p.m., unless under special circumstances, those being considered the two most convenient hours for the purpose.

The distributing instrument at St. Martins-le-Grand is called a chronopher, and the signals are marked off into four classes. These are Metropolitan, Provincial short, Provincial medium, and Provincial long. Contrary to some persons' apprehensions, elaborate experiment has shown that the roundabout transmission of the hours causes no delay that can have any appreciable time assigned to it. Thus the signal reaches Edinburgh just as soon as it reaches London, so far as the measurement of a high decimal of a second is concerned. Although it must absolutely reach the Post Office before it can go to Kendal, or Swansea, the difference in time is so small that it can never be marked as a factor in the second.

We will, ere we conclude, correct a very prevalent error in respect to the Westminster, clock—that is, that its pendulum is controlled in some way or other from Greenwich. This is not so. It is perfectly independent in its action. It reports itself to the Observatory twice a day, and there is a galvanic needle beside it which shows an hourly signal from the standard mean time clock by deflection. Should the clock alter its rate, there are small weights which can be put on or taken off the pendulum to restore the time. It has long been admitted to be the best public clock in the world, and may be generally relied upon to within a second of true time. After heavy gales of wind acting upon its exposed hands, or thunderstorms, it may err by two or three seconds. The first blow on the hour ball, after the quarters have been sounded, is the time.

As we closed our note book we cordially thanked Mr. Criswick for his attentive assistance, and took our departure, full of wonder and admiration at the elaborate system of time-making and the time signals at Greenwich.

The Goldsmiths' Company have recently re-let some property at Acton, the increased rent being about £3,000 per annum.

CITY AND GUILDS OF LONDON INSTITUTE.

An able and instructive address on technical instruction was delivered on Wednesday, 20th ult., in the theatre of St. Thomas Charterhouse School of Science, by Mr. I. Herrmann; Mr. J. A. Lund in the chair. The lecturer most forcibly demonstrated the necessity of supplementing the indispensable lessons of the workshop by a sound knowledge of scientific principles. The address was intended as an introduction to a series of lectures on watch and clock making to be delivered at the above institute by Mr. Herrmann, under the patronage of the City and Guilds of London Institute. Prizes of £5, £3, and £2, with silver and bronze medals, besides certificates are offered for competition. Mr. Herrmann, who was formerly teacher to the British Horological Institute, is well known as having special qualifications for such an office, and there can be no doubt that the City Guilds are materially assisting the trade by the institution of such courses of lectures. The entrance fee for the term is only 6s., and the lectures are held on Monday evenings from 8.30 to 9.30; the last evening for entry being Monday, November 8th. A report of the address will be found in another part of the Journal.

TURNERS' COMPANY'S PRIZES.

The Annual Exhibition of the specimens of hand-turning sent in to compete for the above prizes was held at the Mansion House on the 12th ult. The competition this year has been in hand-turning wood, ivory, and precious stones, including engraving in intaglio. There were twenty-six exhibits of excellent workmanship and design in the wood section; but only five in ivory, and none of them considered meritorious enough for the first prize.

In the classes for precious stones and for engraving in intaglio, the specimens were divided into four classes, and the qualities considered in awarding the prizes were symmetry of proportion and form, brilliancy and polish, accuracy in the finish of the facets, skill in overcoming difficulties inherent to the material, and, as a subsidiary consideration, skilful arrangement of stones to form particular ornaments. In the diamond subdivision of these classes it was requested that rough diamonds of good size should be included. The judges were Mr. Herbert Grueber (of the British Museum), Mr. J. N. Hunt (Hunt and Roskell), Mr. John Jones, Mr. Keller, and Professor Tennant. There were twenty-four exhibits, including stones for watches, Brazilian crystals, onyxes, garnets, carbuncles, corals, turquoises, cameos, diamonds, seals, crystal intaglios, etc. The judges drew special attention to the class containing cameo portraits and crystal and seal engraving of rare excellence, and said the class for cutting and carving in crystal deserved the highest praise. They regretted, however, that the art of cutting diamonds was not represented in all its branches. They awarded the chief prizes in the four classes to Mr. A. Wallace, of 36, Charlotte Street, Fitzroy Square, ; Mr. John Brown, of New Southgate; Mr. Louis Islar, of 5, Oval Road, Regent's Park; Messrs. Reuter and Warner, of 10, Wardour Street; and Mr. Henry Ashwin, of 6, Kirby Street, Hatton Garden.

QUERIES AND ANSWERS.

Electro-Gilding.—A solution of 1 oz. per gallon is capable of supplying as deep a tint as is desirable, provided that temperature and battery power are increased accordingly. Mr. Urquhart states that such a solution produces its darkest effect when the temperature is at boiling point, the battery power two cells of the Smee or Daniell type, and the anode only a few inches from the articles, and that almost any desired shade may be obtained by lowering the temperature, the battery power, and keeping the anode and articles further apart. This experience has taught me is quite correct.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTROPLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. XIX.

(*Continued from page* 37.)

Gilding Bath with Bicarbonates.—I have so fully described the pyrophosphate bath in the last number because I consider it preferable to all others; nevertheless, gilding by dipping may be effected by the use of other substances, particularly with bicarbonate of potash or soda. Gilding baths with bicarbonates were still employed by some gilders a few years ago, but I think it must have been because they were not acquainted with the pyrophosphates or did not know how to employ them. The bicarbonate bath is prepared in a cast-iron kettle, turned clean and smooth in the lathe, and previously gilt by the protracted ebullition of nearly spent gold baths. It consists of—

Water, 35 pounds.
Bicarbonate of potash or soda (potash in preference), 20 pounds.
Pure gold (transferred into chloride), $4\frac{1}{4}$ ounces.*

The whole is boiled for at least two hours, and fresh water added to replace that evaporated. A part of the gold precipitates, in the form of a violet-black powder, and the bath then requires cooling and decanting. The liquor is then boiled again, and the gilding proceeded with in the same manner as before described, except that the mercurial solution should be more diluted than for the pyrophosphate bath. The operation is finished when about half of the gold in the liquor is deposited. The remainder goes to the saved waste. The bicarbonate process is inferior in most respects to the pyrophosphate; personally I do not know any gilder at the present day who makes use of it; and I merely mention the process as a point of interest in the history of the galvanoplastic art.

Diluted Bath for Gilding.'—Before concluding with the enumeration of formulæ for gilding baths suitable for the dipping method I must mention one which is often applied on account of its easy manipulation and the large amount of work which can be done with it. The work is, however, not of a durable nature, and this process should only be employed as a complement to the cleansing, before a more solid gilding. The bath is composed of—

Water, 2 gallons.
Bicarbonate of potash, 7 ounces.
Caustic potash, 63 ounces.
Cyanide of potassium, 3 ounces.
Metallic gold to be transferred into chloride, $\frac{1}{3}$ ounce.

The whole is brought up to the boiling point, and a pale gilding is obtained even upon articles imperfectly cleansed, and without using nitrate of binoxide of mercury. It is possible to add one-sixth of an ounce of chloride of gold several times to this bath without any other substances. Afterwards maintain it at the proper strength by addition of gold and salts, in the above proportions, and it will last for an indefinite period. This bath will gild about 140 ounces of small jewellery with one-thirtieth of an ounce of gold, whereas a pyrophosphate bath gilds only about 35 ounces of small articles with the one-thirtieth of an ounce of gold extracted from the liquor. Large bronze articles are submitted to this bath before passing into the electric bath.

Gilding by Stoning and Gold Amalgam.—This is another of the earlier methods used by gilders for obtaining bright and adherent coats of gold on small copper articles, and the results are analagous to those obtained by the simple dipping processes just described. Proceed as follows:—

In the centre of a charcoal stove put a crucible holding a given quantity of pure and dry mercury, and when the temperature has reached about 212 deg. Fahr., add half the weight of gold. Stir with an iron rod until the amalgam has acquired the consistency of butter, throw it into cold water, and keep it there for use. Cleanse the articles to be gilded in aquafortis, put them in a stoneware pan, and pour over them a diluted solution of nitrate of binoxide of mercury, taking care to move the articles about all the time, in order to cover them with a regular white coating of mercury. Add the desired proportion of amalgam; on stirring the articles this is spread all over them. Then rinse the articles in cold water, place them in a large and deep copper ladle perforated with numerous small holes, and having a long handle, hold the ladle over a charcoal fire, and constantly stir it about in order to have the heat equal everywhere. The mercury of the amalgam is soon volatilised, and the gold remains adherent to the articles. If instead of a yellow gilding a red one be desired, this is got by waxing, which consists in pouring upon the pieces kept in the ladle and upon the fire, in a well mixed and fluid state—

Oil, 25 parts.
Yellow wax, 25.
Acetate of copper, 10.
Red ochre, 40.

The articles must be constantly agitated, and the mixture allowed to burn out, when the whole is thrown into a very diluted solution of sulphuric acid. The waxing is only to be done after the complete volatilisation of the mercury. When removed from the pickle, the gilding has the dull ochre appearance, and must be scratch-brushed. Small articles are brightened in a long narrow bag, where they are put with copper pearls, or the waste from these pearls, and wet with vinegar water; a to-and fro motion is imparted to the bag, and the gilt articles and the copper granules polish each other. Rinse and dry in sawdust and burnish if required.

(*To be continued.*)

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* This weight refers to the gold and not to the chloride.

THE LATEST FASHION IN JEWELLERY.

THE quick eye of fashion, attracted towards Madrid by the birth of the Princess of Asturias, has already seized upon a fanciful idea suggested by the ceremony of the presentation. Upon the golden dish where reposed the new-born heiress to the Spanish crown was placed likewise the ribbon and insignia of the Golden Fleece, that palladium of the noblesse, which is supposed to preserve from misfortune all those to whom is accorded the privilege of wearing it. Instantly did fashion turn aside from the little white mice and the little sucking pigs with which she has been adorning her favourites for some time past, hanging them to the ears, placing them on the bosom, buttoning them on the wrist—nay, was not the most charming little *chic* Princess in Paris beheld the other day with a whole litter of little pigs in silver, playfully scampering after each other down the front of her dress? And now does Fashion declare that all these creatures—pigs, mice, beetles, dogs, cats, and butterflies—must give way to the suspended little sheep of the Golden Fleece. People of taste are glad of the change. At all events there is some interest in the little sheep. It is historical and more seemly than the little pig. All the necklaces now exhibited in the Paris shops are finished with the *suspension* of the Golden Fleece. It is made in pearls or diamonds for full dress, but the real thing is to have it suspended to a gold or silver chain in exact imitation of that worn by the Knights of the Order. Upon a black or purple velvet bodice the effect is novel and striking.—*Pawnbrokers' Gazette.*

REPAIRING SWISS WATCHES.

No. II.

By H. Ganney.

There are two things which distinguish Geneva watch repairing from English and American, and have greatly contributed to their popularity, viz., the facilities which the various actions exhibit for readjustment and alteration by the repairer, and the more frequent need of them. In the earlier make of a Swiss watch it is seen every depth and action can be adjusted by shifting their respective bars, and even end shake screws left to raise or lower the balance cock. Between common watches that can be altered, like the Swiss, and watches of *low* English make, that cannot be altered without much original transformation and disfigurement, there is no need for discussing which will have preference, until machine watches supersede both, and then the jobber's occupation will be gone and, with advantage to himself, exchanged for something more satisfactory. At present he has an intense experience of diseased watches which applied to their production should make his fortune if properly developed. We propose to describe the methods usually adopted to secure performance of the lower grade of Geneva watches, success in repairing which depends on a suspicious vigilance on every part and action, both in taking down and putting up again. A watch examiner occupies a day usually on receiving a new watch going from the finisher in examining and getting it going again, and the retail watch dealer usually lets a reliable jobber have half a day at a good watch when sold, so as to ensure satisfaction before trusting it into the customer's hands, and it is evident if these precautions are assured with good new work, thorough examination, repairing and cleaning about a dozen and a-half jobs per week, which is about the average required, is out of the question. A cursory examination is all that can be given to ordinary jobs, and a day or two's trial hanging and lying must do the rest, and answers ordinary purposes. It is a great advantage to have taken in personally the work from the customer, and heard his account of the general performance; where this is not practicable, the taker-in should note the probable cause of stoppage as a guide to the workman. All watch jobbing is a compromise between what is, and what should be, and to make that which is defective answer a purpose, appears to be its chief characteristic. Watch cleaning and replacing new pieces to good work are easy amusements to every well trained watchmaker. Every watch manufacturing centre has thousands of men who can replace any part of a watch with accuracy, yet quite unable to hold a situation as repairer, unable to secure a performance from the watch as a whole. The watch jobber flourishes in their midst as an imported worker trained outside the manufactory, often unable to replace a new piece decently, and yet earning good wages because of this ability to detect causes of failure arising from defective making and alteration caused by wear, and capable of modifying them sufficiently for present purposes and small purses. Supposing nothing good or bad is known of the watch, it will be well before taking it out of the case to observe the hands, see if the seconds hand run truly and has freedom for the pipe, and see if hands have end shake and are not touching glass at centre. In opening the dome see if jet square is free of case, case springs free of movement and screws. After taking out the movement, your business is to discover what has brought the watch into your hands, and what are the best and quickest means of getting it off your hands for a year or two. The first thing is to seek the cause of stoppage, and when that is settled beyond a doubt the work may be considered half done. If the watch is a good one, careful cleaning is all that is needed; if it is a cheap one on which everyone engaged has had a race against time, a race in which you now are also entered, you need not stop to study its faults—it is all faults. You may speculate upon the limits of badness and possible performance in watch work, and if faint-hearted will return it to its owner with a recommendation to hypothecate it and get a new one; but if you think, like a physician, your business is with the diseased not the healthy, and if possessed of much experience and good theoretical knowledge, a good file and bluestone and a good share of patience and perseverance, you may attack it and be astonished at the reputation you can make out of such trash. This will be about the programme. Looking at the balance it will be found to be slightly rubbing the centre wheel, or the stud or index pins; push the balance in those directions with a peg and apply the file *ad lib.* to the pieces touching. If centre and balance are touching, or nearly touching, consider it foul, and taking out balance, screw the cock on and drive it over with a blow on a boxwood peg with the hammer; see if the required freedom is attained, and that the balance is free of stud and index in all positions. Trying the escapement will come next; generally the wheel and cylinder are right size if the drop is not fairly equal inside and outside the cylinder; it is either too deep or shallow; if too deep, it will set easily in vibrating, and have no drop inside; if too shallow, it will have little vibration, and too much drop and catch on edges of cylinder. The action of the tooth on the cylinder should be closely observed, and if foul or too close top or bottom of wheel, the wheel should be raised or lowered by the arm being pressed in the shallow concave tool mentioned last month. Alteration of the jewel and stone settings may generally be effected by raising or lowering the cylinder action slightly, or to correct end shakes, as the stones are generally set low in the brass. This may be filed level with stone, or the stone replaced by a higher one. Attention to the end stones is of the first importance in common Swiss watches. The top end stone is generally loose, and cannot be fitted properly, as its steel setting is required to be screwed firmly home to hold the index. A small wedge of peg wood is the simplest method of keeping in position the end stone if the index is too loose: the steel setting must be filed underneath to allow its upper or larger surface to come in contact with the index, or its edges must be enlarged by the hammer.

We now examine our train of wheels. If the scape depth, as often happens, is shallow, as shown by much side shake, drive the scape cock by pressure from behind if freedom allows, the seconds pivot hole being always very shallow. A pivot broach pressed by the finger underneath in opening the hole will cut away one side of the hole, into which a French bouchon or stopping being inserted and riveted we have a new depth as the result of a few minutes' work, the wheel being uprighted by driving the cock in the manner already referred to for the balance cock.

(*To be continued.*)

In consequence of the composite character of the Goldsmiths' Court, there appears some difficulty in prosecuting a West-end firm for tampering with hall-marks. It is stated in the trade that the delinquents have made £100,000 by their mal-practices.

A West-end firm have just delivered at the Mansion House some handsome centre pieces and fruit dishes, which were ordered by the Court of Aldermen at the commencement of the present Mayoralty. This addition to the civic plate will cost about £1,000.

By the way, the manufacturing silversmiths complain of the harassing mode in which respectable tradesmen are treated in hall-marking matters, whilst those who defy the authorities go scot free.—*Citizen.*

ART WORK IN THE PRECIOUS METALS.

(*Continued from page 27.*)

Repoussé Work.

THERE are three kinds of repoussé work. *Repoussé au bois* is produced by means of an iron matrix, which is cast from a wooden model, a thin sheet of metal being driven into this matrix by means of pieces of wood. Most of the large objects made in Belgium are manufactured in this way, but only a debassed style of work comes from this process. By *repoussé a tour*, or "spinning," a large number of forms are executed which would be difficult and costly to produce by the hammer. The result is attained by means of a blunt tool, the metal being pressed against a wooden pattern which has been turned into the desired shape.

Next comes *repoussé au marteau*, or the only veritable repoussé. The word repoussé has the same root as our word *repulse*; hence it means *pushing back*, and not pushing forward; all the real part of the work is the driving back of the ground, and not knocking forwards as so many imagine. To execute a work by this process, the workman makes a tracing of the drawing to be carried out, and attaches it to the silver, which has been fixed on some melted pitch, contained in a hollow semisphere of iron, of tolerable weight. As soon as the pitch is hard, he dots through the tracing on to the metal with a fine-pointed punch, striking the punch just hard enough to make the marks show through the silver on the under side that is to be worked on. The metal is then taken off the pitch and cleaned, when the design should be just seen dotted on the back as well as on the front. The workman then roughly drives up from the back any part that has to be very prominent, such as the body and head of a figure, giving only a rough projection where these parts would be, and taking care that they are high enough in relief. The metal is then softened by heat, and again put on the pitch contained in the iron bullet before named. This bullet is placed in a ring of thick leather, generally about six inches in diameter, so as to turn about easily and yet be very firm. And now begins the actual work: the artist driving down the ground by means of small punches, of which a large number are required of every possible shape, round, pointed, square, hollow, and for matting. These punches may number a thousand, and are required of every size, so as to get into the smallest corner. The design is now executed by the artist-workman knocking his punches with a small flat hammer, holding the punch lightly between the finger and thumb, and travelling over the work, knocking it each time he moves it onwards. After going over the plate in this manner, and getting a certain amount of relief, the plate is taken off the pitch, heated to a dull-red heat, so as to anneal it, and then the same process is gone over again, and repeated until the requisite relief is attained, at the last time all the fine shaddows being put in, and the ground receiving a fine "matt" surface by means of a tool called a "mattoir."

If the work is to be a vase, the process is somewhat different. For the execution of such an object, the design has to be first drawn. The modeller then proceeds to model the parts that are to be cast, such as the handles and spout. The body of the work is then beaten into shape, and joined with a solder that only melts just before the silver would dissolve, so as not to be affected when the other parts are put on, for which a quicker solder is used. The ornament upon the vase is now obtained by applying the internal surface to an iron rod which, by frequent blows upon the end farthest removed from that in contact with the silver, is made to vibrate. These continual vibrations, regulated by the skill of the workman, produce the relief. The interior of the vase is now filled with pitch, and the work is finished from the exterior as before described. If to be further enriched with engraving, that is now done, and the handles and other parts are adjusted, and the whole is then ready for polishing.

For all these several parts there is usually great division of labour, and even engraving is divided into several branches, as ordinary plate engravers would know nothing of the engraving of silver vessels, these being done by a very arbitrary mixture of chasing and engraving. Chasing in England is what is termed the work of the *ciseleur* in France, and is a series of hammerings with small punches and chisels, then cuttings with fine tools and gravers. Engraving being done entirely by the hand, excepting large coarse work requiring the hammer and chisel to cut it out; but all fine engraving is done by the pressure of the hand. By practice great accuracy and freedom can be acquired, and so few follow this branch of the trade that all engravers command good wages, there being room for many more to learn this art.

PROPERTY OF THE GUILDS OF THE CITY OF LONDON.

A CORRESPONDENT of the *Citizen* has made some inquiries into the real and personal property possessed by the city companies, and he estimates that their wealth cannot possibly be of less value than a million a year. Out of this the companies only hold themselves accountable as the dispensers of charity to but a tenth, viz., £99,000; the rest they claim as their own property, out of which they may, if they choose, and in fact do, give away much in charity, in addition to the £99,000. The writer asserts that the great bulk of this vast wealth which the companies claim as their own is really trust property, which they hold for the advancement of trade, and which should be applied, as it was when companies were, in fact, what they now are but in name, for the technical education of the working lads of the metropolis.

The following is the estimate of the property possessed by the Goldsmiths' Company alone :—

City property as shown by the city rate books. Gross rental £52,600. Rateable value £43,000.

In Consols, yielding a year	£927	17	6
In other stocks	18,415	0	0
,, ,, ...	914	0	0
In various stocks	6,580	0	0

Or an aggregate annual income from stocks of over £26,000. These figures were taken from a Parliamentary return of their charities, but there are no means of ascertaining what additional investments they have from accumulations or proceeds of properties sold of recent years.

Besides this they own :—

Essex, acreage	40	1	16	gross estimated rental	£140	0	0
Middlesex	238	0	21	,, ,,	2,165	8	0
Norfolk	2	1	0	,, ,,	56	0	0
Sussex	1,997	1	0	,, ,,	1,883	15	0

This does not include any property in the metropolis, particulars of which are not obtainable, nor their stately and luxuriously fnrnished hall, their valuable plate, and other personal property of great value.

TRADE CATALOGUE.

MESSRS. SWINDEN AND SONS, of 27, 28, and 29, Temple Street, Birmingham, have just issued a new catalogue of watch and clock tools and materials, which will prove very useful to the trade. This old-established firm is so well known that it needs no recommendation, but we may state that their direct connection with the best markets enables them to offer special facilities as regards price and quality.

HALL-MARKING.

At a time when this subject is attracting the attention of the trade and the public it may be of interest to refer to the evidence of the late Mr. James Garrard, a former partner in the firm of Garrard and Company, Crown Silversmiths, and more than once Prime Warden of the Goldsmiths' Company, before the Select Committee of the House of Commons on "Silver and Gold Wares," 1856. All who remember Mr. Garrard will know that he was a man of considerable ability.

The following questions and answers are reproduced verbatim from the minutes of his evidence:—

2047. You are no longer carrying on business yourself, are you?—No.

2048. But you were many years engaged in trade as a silversmith?—Yes.

2049. Did you ever turn your attention to the advantage of having any mark at all for silver goods in England?—That is a subject in regard to which persons may very much differ; I suggested to Mr. Cardwell, when this was mooted, that people should, or should not, have their things marked, as they thought fit.

2050. Are the Committee to understand from your having made that suggestion that you see no harm in doing away altogether with marking, and leaving it entirely optional?—That is a matter of opinon.

2054. Supposing that it were entirely optional, and that there was a law merely requiring the name of the seller to be put upon silver goods, do you not think that people would as readily buy goods with the name of your firm, for instance, or any other respectable firm, on the faith of that firm, as if they were hall-marked?—I should think so.

2056. Then, if the duty were taken off, would there not be a very considerable increase in the use of silver articles?—I think there is very little doubt of it.

2071. Supposing there were no mark at all, there would be no reason why any particular standard of silver goods should be made?—I think my observation went to this, that though doing away with the obligation of the mark, I should not do away with the power of having the mark. I think that all respectable houses would prefer having their articles marked.

2077. Is it your opinion that the character of the dealer alone would be a sufficient security for the public, taking the general run of dealers throughout the United Kingdom?—I should apprehend that, with any respectable dealer, if he stated a thing to be of a certain standard, it would be so.

2085. Would that not completely exclude any new firms not known to the trade?—Of course, until a man has established a character, he could not have an established name.

2113. In America there is no assay, I believe?—None at all.

2114. Is it possible for a man to have a pure article of silver or gold in America?—Of course, if he likes, he can.

It is not without interest, also, to note that the report of the Select Committee was only adopted by a majority of one, the minority voting for the principle of voluntary hall-marking:—"That in the new Act to be framed for the regulation of the assay of gold and silver wares, it be no longer compulsory to assay such wares." The minority was composed of Mr. Peacocke, Mr. Ewart, Mr. Dunlop, Mr. Hankey, and Mr. Wilkinson.

Referring to the report of the Select Committee on Hall-marking, 1879, it will be found that history repeated itself, and that again the principle of compulsory hall-marking was only adopted by a majority of one; paragraph 11. Amendment proposed, in line 1, to leave out the words "do not" to the end of the paragraph, in order to insert the words "consider that a voluntary or optional system of hall-marking would be sufficient." (Mr. Muntz.):—

Question put, that the words to be left out stand part of the paragraph. The Committee divided:—

AYES—8.

Mr. Bates, Mr. O. W. Ewing, Mr. Freshfield, Sir Joseph McKenna, Mr. Puleston, Sir Charles Russell, Mr. Talbot, Mr. Torr.

NOES—7.

Mr. Campbell Bannerman, Mr. Courtney, Mr. Goschen, Mr. Hankey, Mr. Muntz, Sir P. O'Brien, Mr. Whitwell.

HALL-MARKING IN AMERICA.

Mr. J. U. POOLE requests us to publish the following facts contained in a letter from a well qualified American correspondent:—

"That a similar institution to Goldsmiths' Hall, with certain modifications, transplanted to America, would meet with the approval of the best manufacturers in the trade. A compulsory hall stamp, owing to the extent of the country, would be too cumbersome for America, but what is required is for Congress to enact a law regulating and instituting a gold standard, and making it a criminal act to misrepresent the standard. A case was recently tried in which a purchaser of a 'gold' watch case, which was proved only to be six carat, endeavoured to get the money back, but he was non-suited, because the quality had not been mentioned at the time of purchase. In jewellery, 14 carat is the recognised trade standard, but very little of it assays at 12 carat. A petition will shortly be presented to Congress praying for a Government standard, which has already been signed by 4,000 retail dealers."

PRECIOUS SPECIMENS OF CORAL.—Among the beautiful pieces of coral exhibited by Messrs. Mazza Guiseppi e Figli, from Torre del Greco, near Naples, at the Berlin International Fisheries Exhibition, was a branch of coral weighing eleven pounds, valued at £600, and another branch, in three colours—white, pink, and red, and which has been in the hands of the family for two hundred years. Also a necklace valued at £1,200, and a beautiful coral signet cut from a bright red piece of coral. The latter is a representation of the royal family of Italy. On the top we find the portrait of the late King, Victor Emmanuel, below him the present King Humbert and Queen Margarite, and below them again their son, the Crown Prince, surrounded by flowers and emblems. The firm of Mazza presented this signet to the King, who accepted it, but desired to have it exhibited at the Berlin Exhibition before taking permanent possession of it.

SIR JOHN BENNETT.—The special reporter of the *Daily Chronicle*, describing the Boulogne fêtes under date of Wednesday last, says:—

"Sir John Bennett has been a conspicuous figure during the Fêtes Communales. The worthy knight attracted not a little attention among French official circles, where he was styled 'Ancien Shérif de Londres.' He was present at the tea-lunch at the College Communal, and at a banquet given by the Comité de Publicité to the municipal authorities and to certain English visitors. Sir John spoke on both occasions. French gentlemen stared at each other when they found an Englishman more vivacious than themselves. Sir John was a host in himself, and his continental intonation and rapid gesticulation were as Frenchified as could be. He spoke in French, varied by the introduction of needful English now and then; and roars of laughter greeted the silver-haired old gentleman as ever and anon he turned round and asked what was the French for so-and-so."—*Citizen.*

MACHINE WORK *versus* HAND WORK.

(*Continued from page* 41.)

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—In my last paper I left the embryo watchmaker trying his "prentice hand" in the construction of steel ferrules. After a sufficient amount of progress had been made, the next process was to "collet" them, *i.e.*, putting in brass holes or "bushes" as they are termed at the tool shops.

As a preliminary, the hardening and tempering steel was practised both for the drills and arbors, and a drill stock had also to be made; it was regarded as an essential point that the drill and the stock should run perfectly true, and this could only be attained by the drills being filed down in a careful manner. Smaller turns, gravers, and bows were now introduced, and serious business was supposed to have commenced. Screw ferrules were discouraged, because the idea was to bring out all the latent powers of the learner and to accustom him to fit everything properly for himself; furthermore, screw ferrules never run true, and ought only to be used by practised workmen. The task of colleting having been accomplished, the art of turning hard and tempered steel was brought to bear in the manufacture of pallet staves, and oil-stone dust, sharp stuff, and fine stuff were employed in polishing them.

Here let me say that the use of square steel for polishers was regarded with disfavour. It is easier to make a polisher out of square steel; but on the other hand very much more important lessons may be learnt by using round steel, and narrow polishers were preferred to broad ones, because the necessary movement on the arbor to cover the whole surface gave a freedom of touch which could be acquired in no other way. It is technically called "crossing the grain."

Rollers were next made out of square steel in the same manner as steel ferrules, and here the progress of the learner depended entirely on his own ability, the drilling of the holes for the ruby pins and filing the hollows over them being in some cases stumbling blocks for a very long period. I know of one escapement maker who worked for many years for a first-class house, who never allowed his apprentices to make a roller until the last year of their time: the work was pitched to a "size" roller and the proper one was applied by himself. This was partly done to prevent the apprentices from becoming too independent; but it also had the effect of preventing them from obtaining a scientific knowledge of the escapement. In making this remark, however, I am rather anticipating future statements, and must return to the manufacture of rollers, or, to be more correct, balance-staves and rollers, because the two were made together. The former were roughed down in the large turns in preference to the lathe, and very carefully hardened and tempered.

If by any chance one had to be hardened thrice over, it was rejected; the result of using such a one generally being the crumbling away of the pivot at the last moment. The best medium for hardening is a tallow candle, and if the object is covered with soap it cleans easily.

The part in a balance staff requiring the most dexterity is the polishing of the slope. Many do this by resting the polisher on the arbor before it is turned down; but it is a far more workmanlike process to turn the arbor down to the proper size, and to polish the slope simply by the "feel" of the polisher. The skilful "crossing of the grain" is a most essential point here. In polishing the front arbor the great thing to avoid is the getting "a lump in the corner"; a small nick should be left from the turning, so that the shoulder and arbor "come up" at the same time.

The practice of this leads the way to making "shoulder" pivots, which were next attempted, and which required the manufacture of a set of pivoting centres. Here again the learner had to depend on his own abilities—no one can give lightness of touch to another—and if after repeated attempts a lad was found to be "too heavy fisted" he would either have to leave the trade or confine himself to elementary occupations.

Conical pivots, although apparently easier, yet require a considerable amount of judgment to make properly; they must neither be taper or bull-headed, and everything depends on the skill with which they are turned and the proper filing of the polishers, also of the beds in the centre on which they rest.

Cutting hollows to pinions and the pendulum collet parts and rivets of balance-staves are points which, at the period I am writing of, were considered of very great importance. One reason for this was that watches were made for men who having received a practical education themselves were able to appreciate these points. Now the majority of our retail businesses are under the management of non-practical men who look to the amount of profit more than to the quality of the work, and it is to them that the origin of Hall-marking foreign-made cases may be traced. I must, however, apologise for this digression, and return to balance-staves. It was rarely that a learner attempted to work one into a frame before he had had some eighteen months' experience; there were usually several apprentices, who used each other's work, the master maintaining a general supervision over the whole. In those days holidays were limited, and any indulgence was strictly based on the amount of work got through. There was no time lost in endeavouring to obtain a supply of work, and everything proceeded with the regularity of clockwork. Each apprentice had a fair prospect of maintaining himself when he came out of his time, and thus there was a general incentive to industry. In my next paper I propose to deal with the making of levers and the arrangement of the escapement in the frame.

I am, &c.,

James U. Poole.

P. S.—The word "business" should not occur before "machinists" in my last paper.

MÜLLER'S PATENT CHRONOMETER ESCAPEMENT.

Mr. A. E. Müller, the inventor of the Normal Chronometer Escapement, which has received some attention lately on account of the marvellous performances claimed for it, writes to us that he is going to submit a marine chronometer provided with his escapement, and a new and simple up and down indicator—but dispensing entirely with fusee and chain, and isochronous balance-spring—to the next Greenwich trials. He further states that his invention has been practically applied since its introduction (eighteen months ago) to every class of timekeeper, and that the results fully bear out his claims. The prepared wood he employs for the arm of the balance is said to be *constant*, the expansion for a rise of 30° on a length of 16 mm. being only 0·0016 mm., increasing the diameter of the balance $\frac{8}{10000}$; the weights thus never change their position, and the moment of inertia remains one and the same.

A model of this Normal Chronometer Escapement, the exact size for a marine chronometer, can be seen by those interested at the office of this Journal.

Mr. J. U. Poole spoke on the silver question at the Social Science Congress, and mentioned that it had been computed that 500,000 ozs. was a moderate estimate of the amount annually worked up into silver jewellery in London alone; that the silver sets worn by ladies weighed from 5 to 10 ozs.; and that it was reasonable to asume that 3,000,000 ozs. of silver were yearly used for jewellery purposes.

ON THE FLUCTUATIONS IN THE RELATIVE VALUES OF SILVER AND GOLD, WITH SPECIAL REGARD TO THE PRESENT DEPRECIATION OF SILVER IN INDIA.[*]

By EDWARD J. WATHERSTON.

ONE of the most curious chapters in the history of civilisation and the progress of mankind is that of the introduction of certain metals, called precious, as general mediums of exchange and representatives of all kinds of property. Thomas Carlyle sketches, in *Sartor Resartus*, the process of centuries in his own graphic way. "A simplo invention it was in the old world grazier, sick of lugging his slow ox about the country, till he got it bartered for corn or oil, to take a piece of corn or leather, and thereon scratch, or stamp the figure of an ox, or *pecus*, to put it in his pocket, and call it *pecunia*—money. Yet hereby did barter grow sale; the leather money is now golden and paper, and all miracles have been out-miracled, for there are Rothschilds and English national debts. And whoso has sixpence is sovereign—to the length of sixpence—over all men: commands cooks to feed him, philosophers to teach him, kings to mount guard over him—to the length of sixpence."

The time in which the "precious" metals became general mediums of exchange is quite unknown, and cannot even be guessed at. But there is little doubt that it was in Asia, and more particularly in that part of it now called India, that the system arose. Gold was, probably, the metal first employed for the purpose, and silver afterwards—perhaps at a long interval. From of old, Asia produced far more gold than silver; indeed, very little of the latter. It was with the discovery of the "New World" only that silver was obtained in large quantities. Thus silver, by the fact of its very scarcity, could not serve the purposes of extended commerce any more than could platinum, which was coined in Russia, for some time. Gold, besides, possessed certain obvious advantages over silver in, at least to Orientals, its more striking colour, its lustre, and its remarkable ductility and malleability. Silver, on the other hand, when it came to be a medium of exchange, was found to be more subject than gold to the influences of air and temperature. It tarnished speedily in contact with sulphur and other substances, besides possessing some further disadvantages. Thus it came that, from the outset, silver was held to be very inferior to gold, and so it has remained to the present day.

As far as can be ascertained from historical researches—undertaken chiefly, and in the most painstaking manner, by learned Germans—the relative value of silver to gold in Asia stood for a long period, embracing many centuries, at 10 to 1. That is, ten ounces of silver were equal to one ounce of gold. Numerous Asiatic coins, gold and silver, which have been preserved, seem to establish clearly this ten to one proportional value. However, there appear to have been exceptions to this rule, which held true chiefly of the countries of India. To those further west, notably in Assyria, the proportional value of gold and silver was different. It is proved by Professor Brandis,[†] who investigated the subject with the minutest care, that in Assyria, three centuries before its conquest by Alexander the Great, the proportional value between silver and gold was a little over 13 to 1.

The Professor established the fact by an examination of a number of plates of gold and silver, engraven with inscriptions in arrow-headed characters, found in the ruins of the Palace of Khorsabad, built by King Sargina, the father of Sanherib, about the year 708 B.C. The inscriptions distinctly stated the value of each plate, and exact measurements showed that silver was valued in respect to gold as 40 to 3, or roughly as 13 to 1. It is known that just about this same period the relative value of silver and gold was 10 to 1. Thus the great "silver question" is certainly of ancient date. A British Parliament discussed it in solemn committee, and very exhaustively, in 1876, and an Assyrian Parliament might have discussed it—with equal profit as far as the world was concerned—some twenty-five centuries earlier.

In ancient Greece, as well as in Rome, the relative value of silver and gold stood between 10 to 1 and 12 to 1. There were frequent changes of value, but all between these bounds. After the conquest of Persia by Alexander the Great, when there came a large influx of gold into Greece, the proportion was for some time as 10 to 1, but subsequently the value of silver fell, and that of gold rose, silver flowing in from various countries on the borders of the Mediterranean, notably Spain. It is mentioned in several Greek works, the well known "Hipparchos" among them, that the relative value of silver and gold ought to be reckoned as 12 to 1. This same figure of 12 to 1 was also admitted in ancient Rome for centuries, up to the commencement of the Christian era. It was at the latter period, during the conquests of Julius Cæsar, that the price of gold in relation to silver suddenly fell to a point lower than was ever known in history, owing to the immense quantities of the precious metal brought by the victorious legions into Rome from the countries which their arms had subdued. For about half a century an ounce of gold was sold by the Roman dealers, in bullion for nine ounces of silver, and for a short space of time the price of gold fell even lower, going down to the proportions of 17 of silver to 2 of gold. When the reaction took place, gold rose again to its former value, and for the greater part of the first three or four centuries after Julius Cæsar, the relative values of silver and gold varied but slightly between the figures of 12 to 1. During the next five centuries there was a general tendency towards a rise in the value of silver. Several edicts of Charlemagne fixed the relative value of gold and silver, throughout the whole of his vast dominions, at 10 to 1, and these enactments were adhered to for at least six or seven centuries after the death of the great Emperor in France as well as Germany. In Italy, during the same period, the relative value of silver and gold underwent considerable fluctuations. As shown by the records of the Mint of Florence, the chief centre of mercantile transactions for the whole of Italy, the relative value of silver and gold was 10½ to 1 in the year 1252; it changed to 13 to 1 in 1324; to 10 to 1 in 1380; to 9 to 1 in 1460; to 11½ to 1 in 1464; and again to 10 to 1 in 1480.

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[*] A paper read at the Social Science Congress, Edinburgh.

[†] Brandis (J.), *Das Münz Maas und Gewichtswesen in Vorder-Asien bis auf Alexander den Grossen.* 8vo. Berlin, 1866.

THE "DEFIANCE" PRESS.

WE call the attention of the trade to the "Defiance" printing and copying press, as the possession of one of them will save the considerable and ever recurring outlay for bills, circulars, tickets, &c. The press is simplicity itself, strong, and so easily worked that any boy may be entrusted with it. These presses are now made in two sizes:—No. 1 press, 25s., will print anything from a small card to a window bill 11 by 8, complete with 1 lb. of type, ink, bodkin, improved roller, and instructions. No. 2 press, 42s., will print anything from a single line to full size of press, 15 by 11, complete, with 2 lbs. of type, ink, bodkin, roller, and full instructions. The manufacturer, Mr. Clement Malins, of 58, Hill Street, Birmingham, has an unlimited number of testimonials from printers, shopkeepers, &c., testifying to the excellency and usefulness of his press. The purchase of a "Defiance" press is certainly one of the best investments that a shopkeeper can make.

THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.[*]

By M. Grossmann, Watch Manufacturer,
Glashuette (Saxony).

(*Continued from page* 43.)

51. The drawbacks of the free spring are the following:—

(1.) The absence of distinct perception marking the end of the winding operation. This objection can be removed by cutting three or four vertical grooves into the inner cylindrical surface of the barrel, and by giving the end of the spring a slight bend outward, so that it penetrates a little into one of these grooves. If the maximum of tension of the spring is attained, the end of the spring will no more be arrested by the hold in the groove, and slips into the next one, thereby giving an easily audible click, which is a warning that the winding is completed. This sudden little motion is at the same time perceptible to the touch. (2.) The great inequality of traction, which must necessarily exist between the two extremities of the development of the spring. This objection seems to be a serious one at first sight, because the watch, if not regularly wound, will continue to go till the tension of the spring is almost exhausted; and it cannot be doubted that in the last hours of expiring march the watch may show some alteration of rate as compared with the rate it keeps when regularly wound. But everyone will admit that no watch can be expected to perform in an irreproachable way if it is subjected to such careless treatment; besides, let me ask, what would be the consequences of a neglect in winding a watch provided with the stopwork? It would lead to a total stopping of the watch, a rather disagreeable occurrence, especially when travelling; and it is precisely under exceptional circumstances that the winding is most likely to be forgotten. In such a case the owner of a watch with the free spring would have to acknowledge it as an advantage that his watch maintains its march, if even with a deviation of some minutes, which, however, would be hardly possible with a good watch, even under such uncommon circumstances.

52. Thus, the two principal objections against the free spring are completely attenuated. But there are several practical difficulties which make most watchmakers averse to its employment. This is chiefly the inconvenience of being obliged to keep an assortment of free springs, besides the stock of common springs for cases of breakage, and the higher price of the free springs adds to the weight of this argument. Springs of the common kind, on the contrary, are cheap and easy to procure.

These circumstances made me reflect whether there was not some means of enjoying the incontestable advantages of the free-spring, without resigning the facility of replacing a broken spring of the usual system. I think I have discovered a remedy; at least one available in a case of need. I take a common spring of suitable breadth and thickness for the barrel, and I break off a piece of the outer end, corresponding in length with the interior periphery of the barrel. Out of the end of this piece I form a hook to which the spring is hooked in the common way, so that the detached piece extends backward in the direction of the length of the spring.

This arrangement has the effect that the pressure of this piece against the inside of the barrel increases with the tension of the spring, while with Philippe's arrangement the traction of the spring diminishes the friction of the outer turn; and this is the reason why this latter contrivance requires the detached pieces stronger than the spring itself. In the modification just mentioned, a piece of the mainspring itself is sufficient, and its resistance may be increased by the grooves in the barrel and by a projection punched at the end of the piece, and lessened by shortening the same. I think a spring arranged in this way would soon make friends, because it offers all the advantages of the free spring, without its difficulties for the practical repairer. At any rate it offers the means of providing a watch, in which a free spring is broken, with a new spring in suitable conditions, from the ordinary stock of springs on hand.

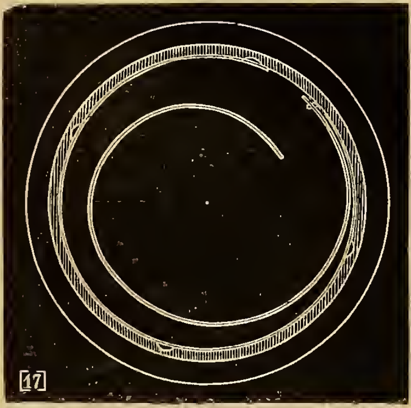

Fig. 19.

CHAPTER V.

The Train.

53. The first condition for the construction of the train of a watch is to make it of as large dimensions as the diameter of the movement will admit of. The very limited space allowed by the reigning taste for the movement of a portable time-keeper is already an impediment to the attaining of a high degree of perfection in the gearings; and if it is possible to execute the wheels and pinions of a clock with a satisfactory degree of accuracy, it gets more and more difficult to do so, according to the smaller dimensions in which the work is to be executed. If we had the means of verifying easily the accuracy of the division and rounding of our small pinions, even of the best make, we would soon come to the conclusion that it must necessarily diminish with their dimensions. The inequalities and alterations of shape by the stoning and polishing will be nearly the same with a large pinion as with a small one, only the small one suffers proportionally much more under them. This applies to the manufacturing of the pinions; but before the pinion runs in the train, it has to pass through the finishing process. The finisher first of all will have to verify whether the pinion runs perfectly true, and to set it true in case of need. In all operations of this nature the operative has to rely on his eye for distinguishing whether the state of the piece is satisfactory. But the eye, like all the senses of man, is reliable only within certain limits, and if a good workman pronounces a pinion to be true, this statement must not be taken mathematically; it can only be understood so that an experienced eye can no more detect any deviations from the truth of running. There are, then, in any piece of workmanship some small defects escaping the most experienced eye, and their absolute quantity is about the same for the large pieces as for the small ones. Let us suppose, for instance, that a careful workman, when turning a pinion of 3 m. diameter, cannot perceive any defect of truth beyond one-hundredth of this size—say 0·03 m. The same defect, indistinguishable to his eye, with a pinion of 1 m. diameter, will be, not one, but three-hundredths of it; consequently it is of threefold more importance with the small pinion, taken proportionally.

The same considerations will, to their full extent, apply also to the correctness of the depths, or gearings; and it will be clearly seen that it is of the greatest importance to construct the acting parts of the train as large as the diameter of the watch will admit of.

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TECHNICAL INSTRUCTIONS TO WATCH AND CLOCK MAKERS.

By I. Hermann.

Though much has been said and written about technical education, it is still only partially appreciated or understood, questioned by some, and objected to by others. "What is the use of it?" has been a question of social discussion generally and for years past, is one prompted by personal interest, and, whether asked in irony or in earnest, it demonstrates the fact that its importance is more or less felt by all. What is the use of it? is a most direct practical question that I will endeavour to answer in as practical a manner as I can.

Is it then possible that any mode of education can assist the practical watch and clock maker—make his task easier and more sure of success? Is his work better and he a better workman on account of it than without it?

Speaking from my own personal experience as a workman to workmen, I offer my unreserved testimony in the affirmative; and as under present circumstances it may appear to be prejudiced by personal motive, you will pardon me for mentioning that I could prove my faith in it by virtue of sacrifices on its behalf proportionally greater than perhaps any watchmaker in London.

But I think I can give you more substantial evidence than this. If we examine the conditions involved in work in general we shall find that it will fill in a missing link, a want often felt, though unconscious and undefined. But what is work?

Work is that combination of circumstances which is the result of, and in harmony with, a pre-existing idea, plan, or design, in contradistinction from that called accident which is wholly without an apparent designer. In other words, it is an effect which can be traced to a purpose. Thus the man who breaks up a house is doing work, as well as he who is building one, because both proceed on a preformed plan. It is the case with any kind of work; this necessity of a designer is so self-evident that Pakely made use of the well-known illustration, the inseparable relation of a watch and clockmaker, to prove a first cause in the creation of the universe.

The more we look at the fact the more certain and important does it become.

It does not matter how insignificant a piece of work may be, whether it is a pin or a plain screw, we must have a clear idea of what is to be done—have, so to speak, a picture of it in our minds before we can form in solid material; and in proportion as that idea is more or less distinct and correct are we successful; hence a workman failing in anything is invariably told that he does not understand his work, which signifies that he had not a clear idea of what he had to do, and hence the failure.

I desire, here especially, to guard against being misunderstood. It might appear that by laying stress on this that I am attempting to ignore skill and practice, but this would be a great mistake. I am essentially speaking of that which underlies skill, and which is necessary for its perfection. Skill, or the art of executing, is a separate part; it is a method of action, and belongs to the workshop. An ordinary watch or clock is such an article of copying that we lose sight of the fact of a design; but when we go to a building, or read a good book, we lose sight of the operator and our thoughts recur to and pay homage to the designer, the architect, the author. Since, then, it is true that the most simple thing demands a design, the importance of design in more complicated work rises in proportion, and we may ask, What is design? If we examine a photograph, be it a portrait or a picture of any inanimate object, we pronounce it good or bad in the measure in which all the points, proportions, and conditions are true to the original. Now just as this picture stands in relation to the object projected, so does work in relation to design.

Design is the prototype of work, and work the picture of design. It therefore follows that the conditions on which success in work depends, demands that the design should accurately represent all points involved; and just as a sum will be wrong if the smallest fraction is omitted, so must that work be more or less a fraction where one condition to be satisfied has been left out or is unprovided for in the plan.

But a design of any piece of mechanism such as the watch and clock-maker has to deal with goes deeper still. The laws relating to forces and proportions are absolute, and rise superior to the designer: they are not at his will; hence any design which treats and disposes them erroneously must produce failure in work, just as a depth can never act however well the pinion is done if it exceeds a certain proportion.

It is this fact that has given rise to that technical paradox, namely, that theory is of no use. The idea or opinion thus expressed in relation to the practicability of theory is useless; the force of this objection must vanish; yet the very tenacity which some men exhibit in holding the opinion that opinions are delusions proves their own incautious faith in design. They are like the man who was such an enthusiast for toleration that he knocked down everybody who did not believe in it.

The misuse or abuse of anything is no argument against its use. No doubt in hundreds of cases work has failed by reason of the design, but to exclude theory on account of this would be reducing all order to chaos.

Having shown both positively and negatively that design is absolutely necessary, that it should fully comprehend all points, conditions and forces involved and satisfy each one, the further question presents itself—How is this knowledge best obtained? Is the ordinary workshop routine sufficient and able to supply this need? I say, as a rule, not. I may just mention in passing, speaking of design as I have done, it might lead you to think it excludes the work of the repairer or jobber, whereas the contrary is true. It is the work of the jobber to restore things to their original condition, and hence by reason of this nature of his duty and the varied forms with which he comes in contact, requires more than any other to be well at home with primary principles; and where he has not he more or less gets into trouble.

I say, then, as a rule, the workshop alone is insufficient. I say as a rule, because the practice of the workshop rests on the assumption that knowledge or experience precedes work. I am speaking of work which is more of a scientific character. Of course there are branches in watch and clock making where the whole rests on one plain idea, and therefore is more or less repetition.

True, observing, practical men gather a certain amount of experience which is invaluable; but confine experience within its own sphere, exclude all communicated truth, and you will see it is a very slow schoolmaster. Let any watchmaker take notes of the various conditions that have to be satisfied in a watch or clock, and then estimate how long it would take a man who would desire to become qualified with them by experience or practical deductions alone, and he will soon come to the conclusion that a life time would be wholly insufficient.

Hence the practical watchmaker must trust to separate information, outside the circle of practice and experience. Still it is unquestionably true that men have apparently learnt their trade in this way, and have outstripped many with abundance of information at their command. How is this to be explained? The cause lies primarily in the difference of latent energy and the development of mental capacity that this exercise produces.

The very fact of a young man engaging to learn a science or a trade unaided shows a force of character and perseverance which generally grows by the difficulties it encounters; such a one would be ever watchful to gather information, and would almost incessantly ponder over and reflect on his observations. In the other case you have a character of the very opposite kind. Any master knows that if an apprentice will not take the trouble to think and reflect and digest the information given him, he never can or will learn. The truth of this will be readily seen. Reverse the case, leave the phlegmatic apprentice to his own resources while you satisfy every inquiry of the other, and you will soon see what it will tend to.

Now we see that a watchmaker requires truth communicated to him, and communicated in such a manner that it becomes a mental exercise—a source of information as well as of education.

This is technical education: it is an inquiry into and tuition of the reason why.

I think it desirable here to meet an objection I have heard and seen in print. It is said that watch and clock-makers are not sufficiently agreed upon many things, and therefore no definite system of education can be adopted. This objection only shows the objector requires a little more education.

If you suspended instructions in every branch where no absolute agreement exists, you would create a large blank in the educational programme.

Ignorance does not diminish controversy, nor are its abodes types of the millennium; while truth on the contrary, is found in enlightenment, and agreement in truth.

But apart from this it is not my business to teach any rigid system of watch and clock-making, nor is it at my discretion, but in harmony with the arrangements of the City Guilds. What then have I to teach, and in what manner? If you look at either one of the papers of the City Guilds or the Science and Art Department, you will see that the object of the examiners is to see if the candidate has understood his lesson; and wherever he anticipates or suspects that the answer rests on superficial grounds, I believe he allows no marks. This then will suggest the mode I have to adopt. That is to say, information will be communicated with the object of supplying the need of the workman and developing the mental capacity which is necessary in skilled labour.

We shall proceed strictly analytically; that is, resolve the various parts to their elements and make ourselves well acquainted with the component principles, in as far as an elementary course will admit.

The elementary paper of last year appears superficially very elementary; but if you look carefully into it and set down and answer every question, many a one will change his mind before he has done with it. The fact that the City and Guilds combine mechanics with their technological questions is an inevitable result. Watch and clock-making and mechanics are inseparable; indeed, many problems in horology can only be explained by facts in mechanics. Then, again, as to the use of terms, there are so many conditions in mechanics which popular language fails to explain or represent; hence an exceptional wording has to be employed; but this is not an exceptional usage. Every trade has its own technical terms—the watch trade has, and so has every science. Then, again, facts in mechanics are reduced to geometrical conditions. Thus, for instance, the fact that a short pendulum performs its vibrations quicker than a long one, though the arcs are equal, is a fact in mechanics, but the full solution is rendered in geometry. Indeed it may be asked, What is language? All communications between man and man (or their general terms of language) are based on the primary condition that the sign, figure, or term used by the author conveys a duplicate idea of the thing signified. If this hold good in everyday life it is still more important in relation to ideas represented by terms in mechanics, and hence it is that they must necessarily form part of our programme.

In the strictly technological section of our programme we shall enter into the general conditions of depths, the results of variations of sizes, and line of centres. The conditions of form of teeth, etc., belong to the advanced stage; then in escapements our lessons will deal in descriptive sense—the more minute detail and geometrical properties and conditions of turning are beyond the elementary stage. But the exact limit cannot be determined in the onset, because it will depend on the time it will take of acquiring the lessons as we go on. But I can assure intending students that nothing on my part shall be wanting to make the lessons as thorough and as full as possible.

Now as to the method to be employed. Each lesson will be given that students can take ample notes, so that their note-book becomes their text-book, therefore no outlay for any other will be needed.

After each evening I shall give problems and questions for home work, to which I shall expect each student to bring the written answer, which I shall in my turn examine. This will give them the means and opportunity for exercise, and likewise give me the chance of seeing how far I have been understood.

Lastly, as regards the regulation of the City Guilds. To my mind, the work of the City and Guilds Institute confers a great benefit and advantage to workmen. When, therefore, I see how miserably it is appreciated, I can only conclude that it is not yet understood. Apart from the educational advantage, I lay special stress on the certificate.

It may be known to some here, as I know it is to the chairman, that years ago I worked hard to get this certificate question accepted by watchmakers. I need hardly tell you that I failed, nor need I mention the cause of failure; still from this you will understand me when I say that I hailed this announcement of the City Guilds with great pleasure, but also disappointed that by the passed list I find how meanly the trade has responded to it. It is not now my business to enter into this separately, but I may say that to a young man starting in business it is a help, and will do much on the other side to neutralise the extensive system of a questionable practice by a class of people who call themselves watchmakers, and hence I have firm faith in its appreciation in the future.

Regarding the conditions of entry, I beg to remind intending students that they have to enter on the understanding that they do their best to pass. The fee of six shillings does not meet the expenses, and the balance is made up by the City and Guilds Institute on condition that the student passes their examination. These terms only apply to young men *bonâ fide* engaged as watch and clock makers; amateurs can be admitted, but only on a special fee.

The condition of prizes is simply a question of efficiency in answers, and they are open to every student. The examinations are conducted on the system of the Science and Art Department, in the impartiality of which I have unqualified confidence.

BRITISH HOROLOGICAL INSTITUTE.

A LECTURE on Hall-Marking will be delivered on the 18th inst., at 8 o'clock, at the above institute, by Mr. James U. Poole.

THE ART OF THE SILVERSMITH.

By W. Herbert Singer.

(Continued from page 46.)

THE style of these two centuries in Italy is one peculiar to herself, and of which she may indeed be proud. Although it was, in a certain sense, a revival of the old traditions, it was to the sixteenth century that the term of the "Century of the Renaissance" has been given.

The sixteenth century was, above all others, a time when classical subjects were most produced, the silversmiths being among the first to conform to the popular taste. Indeed, the style now practised was well suited to the commoner objects executed in gold or silver, but it is doubtful if the grandeur of the two preceding centuries could be attained in their larger and more ambitious works.

One great reason why the work of the latter part of this century did not reach the high standard of the sixteenth is, that it was about this time one detects that the artists and the workmen are not one and the same individual. The designer was now a person in a higher social position than the plebian artisan who executed his thoughts. There, then, was the beginning of this fatal breach, which has done more injury, and more to prevent future progress, than all else to this noble branch of the industrial arts.

But just before this fatal change took place, there lived an artist who seemed to unite in himself the genius that usually falls to the share of a generation of artists.

Benvenuto Cellini is the artist of all others who represents the silversmiths of the revival, as Michael Angelo and Raphael represent the painters and sculptors. He was born at Florence in the year 1500, and at the age of 13 was placed in the workshop of Michael Angelo. The first work of which he speaks in his memoirs is a silver buckle; upon it were represented in low relief cupids and grotesque heads, intermingled with foliage. When 19 years of age he went to Rome, and during the two years he resided in that city devoted himself principally to the study of ancient examples. He then visited various places, and amongst others his native town; but in 1523 a quarrel obliged him to quit Florence, and he again returned to Rome, where he remained until 1537, and it was at this time that he gained much of his renown. In 1540 Cellini paid his second visit to Paris, and remained five years at the French Court, during which time he executed many important works for Francis I.

Had we not the short account by Vasari of this remarkable man, and if there were only his own autobiography by which to judge of his merit as an artist, we may well have doubted if the vast reputation of this artist, workman, and author, was not gained more by his pen than by works of his creation. Let us, however, form our opinion of him as a citizen from the well-known memoirs in which he gives such a graphic description of his various doings; and, as an artist, from what another says of his work; and before Cellini is accused of being a man of the worst character, we must bear in mind the state of society at the time in which he lived. All the dangerous vices of a highly cultivated people were allowed to flourish without any restraint whatever; but, notwithstanding this, Cellini has painted him in no enviable light. As an artist, however, he must have had the highest position, and his works were, without doubt, held in the greatest estimation.

The Italian biographer, in his "Lives of Painters and Sculptors," speaks of him in the following glowing terms:—"Benvenuto Cellini, citizen of Florence, at present a sculptor, in his youth cultivated the goldsmith's business, and had no equal in that branch for many years, nor in making fine figures of alto and basso-relievo, and every other work belonging to that ingenious art."

Before we take leave of the great Florentine artist, I must mention that he, like Theophilus, wrote a treatise on the silversmith's art. In this he describes the method of making jewellery, composed of gems, the composition and application of niello, the art of filagree, enamelling, jewellery properly so-called, that is the art of forming, from sheet gold or silver, the little figures with which he so richly decorated his work. He also speaks of the engraving of coins; but the most interesting portion is that wherein he explains the process of making gold and silver vases, and silver statues of even the size of life. One method of ornamentation much used during the sixteenth century, and which received so much attention from Cellini, is damascening, or the art of forming designs in gold or silver, on iron, bronze, or other hard metal. This is one of the most interesting processes used in the decoration of metal work, and I am able to illustrate the method of producing this work by two specimens, the one in an incomplete stage, and the other the same design finished.

Spain was one of the first countries to follow the great example set by Italy. This may be explained by the frequent intercourse then existing between these two nations, and also through the unsettled state of their art after the evacuation of the country by the Moors. It was now that the discovery of the New World poured into Spain a hitherto unheard of supply of the previous metals, especially of silver, and as one would suppose of a people so devoted to their religion, large quantities of these riches were made into church plate, and given to various cathedrals and churches throughout the land.

Perhaps, after Italy, in no other country of Europe flourished so beautiful and characteristic a style as that which was developed by the Germans during the sixteenth century; and, what adds an additional interest to it is, that it is a national art, a creation of their own, and not, as was the case with the other countries, a direct copy of the Italian Renaissance. At the commencement of the century, the traditions of Gothic art were much adhered to, the constructional lines of that style being generally used, but they were greatly modified, and afterwards almost entirely superseded by the vegetable forms, which, at first, were only entwined round them, but by degrees these ornamental branches formed the essential part of the design in much of their silver work. This peculiar characteristic was impressed upon their art by an eminent group of artists, at the head of whom was Albert Durer, and the style of which I speak will at once be detected in many of his etchings. The work that was now produced in this country does not, of course, bear comparison with the masterpieces of the Italian silversmiths, but this German art has a grandeur of its own which can only be obtained by earnest endeavour in an original style.

A Fine Specimen of Horological Art has been lately added to the Germanic Museum at Nürnberg. It has been erected at the expense of the Princes of the Royal House, and is intended as a memorial of the Wittelsbach Jubilee, celebrated some days ago. The clock is placed at an elevation of 14·2 metres, or a little over 46½ feet. It is surrounded with ornamental work in mediæval style, and several gilt figures, most of which move by mechanical arrangement. The idea intended to be expressed is that the Bavarian people at all times reverences its king, who governs under the protection of God. Above is the sitting figure of the Saviour, and below that of Louis II., also seated. Around the Saviour are arranged eight angels, some of whom strike the clock bells, others blow trumpets or hold a curtain behind the king, before whom two citizens bow down reverentially. An inscription records the object and authors of the work. The old arms of the Palatinate are set below. The whole work is in the style of the fourteenth century.

THE WATCHMAKER JEWELLER AND SILVERSMITH'S TRADE JOURNAL.

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

Entered at Stationers' Hall.—Registered for Transmission Abroad.

CONTENTS.

	PAGE
Machine Work *versus* Hand Work	59
The Silver Trade	60
Hall-Marking..	60
Practical Instructions to Jewellers, Silversmiths and Electro-platers	61
Book Notice	61
Repairing Swiss Watches	62
Robinson (Goldsmiths' Company) *versus* Currey	63
City and Guilds of London Institute ..	63
Greenwich Chronometer Trials	64
South Kensington Museum	64
Statistics from the Birmingham Assay Office	64
On the Fluctuations in the Relative Values of Silver and Gold, with Special Regard to the Present Depreciation of Silver in India	65
Abuses in the American Jewellery Trade..	66
Improved Patent Musical Boxes, Orchestrionettes, etc.	66
The Construction of a Simple but Mechanically Perfect Watch	67
Lectures on Watch and Clock Making ..	68
The Art of the Silversmith	70
Patents	i
Monthly Record of Bankruptcies	ii
Directory	iv
Advertisements	i—xii

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MACHINE WORK *versus* HAND WORK.

(*Continued from page* 53.)

(*Continued from page* 53.)

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—I will now assume that the apprentice is sufficiently advanced to attempt to "go through" with an escapement to a full plate frame. It is not my intention to lay down the scientific proportions of the various parts of the escapement, which have been often dealt with in other publications. I am bound to admit that I used a gauge for the dimensions of rollers and levers, and also of the planting out of the escape wheels, which had been proved correct by the long experience of others; and, as a matter of fact, those who profess to be governed by the strictest rules of geometry, and who make most use of algebraic signs, are constantly obliged to put their theory on one side and accommodate their work to the varying proportions of the frames.

Furthermore, my experience as a manufacturer enables me to say that no two escapement makers have the same notions of what is correct, and each will vigorously defend his own system.

Now let me return to the escapement in course of construction. The roller would have half the edge below the upper plate; the pallets were put on an unfinished pallet staff, and touched in the turns with the graver to test the straightness of the hole, and the shoulder of the upper pivot marked the proper distance from them. The staff was then taken to height, and the pivots finished; after this the escape pinion would be pivoted and the collet driven on for the wheel. The truth of the wheel was tested on a special arbor; if one part was higher than the other it was supposed to be corrected by drawing the hole; but I am bound to say that very few workmen took the trouble to do this effectually.

The lever was then made, and many would be the failures in drilling the guard-pin hole and filing the notch over it. As a preliminary the beginner would be practised in simply filing the four hollows; to do which many hold the lever in clams, but I was always taught by my father to use my fingers, and am satisfied that real, true work can only be produced by the same means. The effect of putting the lever in a tool is to make it more difficult to look at; and it is a common fault of ordinary workmen to file and polish the hollows and ears of levers "towards" themselves. The only way to obviate this is to continually look straight down the object in the fingers. A trained workman may be picked out by simply requesting him to look at a piece of work. The notch and ears of the lever were made right for the roller in the depth tool, and if the learner had been expert in polishing the slope of the balance staff without resting the polisher on the arbor, he would experience little difficulty in filing the ears of the lever. On the other hand many a lever has been spoilt through the opposite corner of the notch being taken off by the file. Some escapement makers avoid this by filing the ears with a round file; but this construction is objectionable owing to the pin being so liable to catch on the extreme corner in coming into the notch. The pallets having been drilled, the lever was put on the staff, and the depth marked on the inside of the top plate. Next came the pallet and wheel depth, and at the same time the pallets were supposed to be examined to see if the outside and inside drops were equal, and also if the lockings were correct, *i.e.*, they should draw up to the bankings after scaping. Twenty years previously to this it was a common thing for escapement makers to make their own pallets, and still more common for them to make important improvements in them; but at the time I write of the pallet makers were thoroughly up to their work, and the examination was generally a matter of form, and by degrees fell into disuse. The top hole having been carefully drilled in the upright tool, and the depth roughly examined, the mandril was brought into requisition. The upper plate was set up first, and after it had been ascertained that the hole ran perfectly true, the pillar plate was pinned on, and the centre caught at back. This operation required a good graver and a steady touch, otherwise a "pip" in the hole would be the mortifying result. The drilling being at length accomplished, the depths were examined, often with the result of breaking off the lower pallet staff pivot through catching the lever on the potence in taking it out of the frame. The only way to avoid this is to turn the frame downwards and make sure that the lower pivot is not being drawn up by the pillar plate while lifting it off. Many test the wheel depth by moving the pallets by means of the lever and balance; but I was always taught to try the wheel depth separately. A piece of nicely cut cork was placed under the tail of the lever to steady it, and the depth and drops could be tried with great certainty and deliberation.

The most effectual test of the correctness of the proportions of an escapement is supplied by the bankings. Assuming that the depths are right, the "run" of the pallets ought to be the same as the shake on the bankings, and if the wheel has been so planted that the lever lies straight along the pallets, the proportions may be very safely used as the basis of future operations, assuming always that the angles of the pallets are the same. The bankings being correct, the lever was so adjusted on the pallets that the locking down was equal on each pallet, and then drilled off; after which the work was polished up, the details of which I shall pass over, merely observing that great stress was laid on the cleanliness and good condition of everything that was used. Also all tools were properly put away each night, and the drawers were expected to be kept in good order. I lay great stress on this point. There are many workmen who never put their tools away, and their boards are in such a chaotic condition that it is marvellous how they produce any work at all. The polishing being finished, the work was put together. First the pin would be shellacked in the roller, the first trial having been with a burnished brass one; this operation often resulted in turning the roller into a beautiful "straw" colour, necessitating polishing it over again. It was also very liable to be scratched in cleaning off the shellac, which would collect around the pin. The wheel would then be burnished on the collet, an operation really requiring great dexterity, and seldom attempted by an apprentice for several years.

The same with the pinning together of the lever and pallets. Foreigners almost invariably screw them together, sometimes by the pallet staff itself, and genuine English work can generally be detected by little points of this kind.

The general way is to drive the pins into the pallets from the top side of the lever. By this means the largest ends of the pins are uppermost; but I was always taught to fix the pins in the pallets first, and after shortening them, to press the lever down on them and then rivot the ends over with a suitable punch. By this means a "perfect fit" was ensured.

As the small ends of the pins were in the lever, it was easier to make a slight alteration, if the locking down was unequal, without there being so much risk of breaking the stones of the pallets. Having brought the escapement up to this point, I will assume it finally examined by the master, and by him put away in the box with some such admonition as this.—"That and 'better' *may* do, but that and 'worse' will *never* do." It is, however, rather an extreme case to suppose one apprentice performing all the operations I have described, as for commercial reasons the work would be distributed according to the various abilities of those in the workshop, so as to produce the best results. Twenty-five years ago the American work was in full swing, and "carte blanche" was given to most manufacturers as long as they produced adequate results. It is sad to say that many, in their haste to grow rich, abused this license, and we suffer for it now; but others conscientiously endeavoured to discover what kind of escapement would produce the best results. Two-pin escapements were very popular then; some had jewelled notches to the roller, and a jewelled stone, instead of the two gold pins. Gold scape wheels with club teeth were experimented with, but I am bound to say that the escapement which seemed to give the most general satisfaction was the single pin, with ordinary shaped teeth to the wheels. In my next, and closing paper, I must refer to the causes under which the work deteriorated, so as to pave the way for the competition of machine labour.

I am, &c.,
JAMES U. POOLE.

THE SILVER TRADE.

We extract the following from a letter addressed to us:—

"During the delivery of his lecture on Hall-marking at the Horological Institute, on the 18th ult., Mr. J. U. Poole specially referred to the subject of the depreciation in the value of silver, as alluded to by Mr. Watherston in the paper which he read at the Edinburgh Social Science Congress. The committee appointed to enquire into the question in 1876 did not consider that the amount of silver used in manufacture was sufficiently large to call for their serious attention, and Mr. Giffen, in giving evidence in 1879, estimated the entire amount used for the purposes of manufacture at 4,359,000 ounces, of which quantity only 800,000 ounces was taxed, or not one-fifth. Since then, the latter amount has decreased considerably, while the total consumption is probably on the increase, so that the "hatred of silver" alluded to by Mr. Watherston in his paper is confined to one-seventh of the entire quantity used in the country.

Mr. Giffen said that the increase of 100,000 or 200,000 ounces used in the manufacture of silver plate might have an important effect on the price; but he previously referred to 500,000 ounces, which was said to be obtained from lead, as a small quantity, and one that would not affect the calculation to any extent.

HALL-MARKING.

A LECTURE on Hall-marking was delivered on the 18th ult. at the British Horological Institute by Mr. J. U. Poole, but nothing was said on the subject that has not already appeared in the columns of this journal.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. XX.

(*Continued from page* 49.)

The following process is very simple and often useful for gilding silver. It was formerly, and also at present, occasionally employed for gilding the inside of snuff boxes and similar articles. It is called

Gilding with the Rag.—Dissolve finely laminated pure gold in aqua regia, made of—

Nitric acid, 5 parts;
Sal ammoniac, 2 parts;
Saltpetre, ½ part.

Heat carefully upon a gentle fire; when all the gold has disappeared, pour the cooled contents of the flask into a flat-bottomed stoneware pan. Into this liquor place one upon the other, and in sufficient quantity, squares of linen cloth, strike them with a glass rod in order that they may equally absorb the chloride of gold. Each square of cloth is taken out with wooden pincers, well drained, and spread for drying in a dark chamber. When nearly dry, each piece of cloth, supported upon glass rods, is placed on top of a charcoal fire, and soon burns. The combustion is aided by the presence of the saltpetre, and is finished upon a marble slab. Grind the ashes under a muller, collect and keep them between the folds of a parchment leaf, around which a wet cloth has been folded. The powder is then ready to use. Mix it upon a slab with a few drops of water, and with this paste rub the well cleaned surfaces of the silver to be gilt. The smooth surfaces are rubbed with the thumb; the fillets or grooves with a fine cork cut to the proper shape, and the corners or angles with a stick of soft wood, such as linden or poplar; the articles are then burnished. This gilding is very thin, but quite resisting, especially after the action of the burnishing tool, which forces the gold into the pores of the silver. If a red shade be desired, add a small proportion of pure copper to the gold to be dissolved in aqua regia.

By the action of the fire during combustion of the linen, a considerable part of the chloride of gold is reduced to the metallic state, and the remainder is transformed into protochloride. The presence of the latter body in the compound appears to us to have a great deal to do with the coherence of this kind of gilding; protochloride of gold decomposing readily in the presence of silver to form chloride of the latter metal.

Gilding with the Brush or with Shell Gold.—This gilding process offers very little solidity, and is only applied on very small surfaces. It answers the purpose of repairing slight defects in finished articles, defects not serious enough to require a repetition of the gilding process. A gold powder is simply mixed with gum water, applied with a brush upon the parts to be covered, and allowed to dry. The gold powder is prepared by rubbing the cuttings of goldbeaters' foil under the muller, to prevent them from being blow away, add a small quantity of white honey. When fine enough, put the paste into water, by which the honey is dissolved. After several washings, settlings, and decantings, allow the powder to dry. In case of hurry, the washing may be performed upon a paper filter. The dry powder is again ground with a little gummy water, and the paste spread over the inside of a mussel shell. If a green gold powder be desired, mix silver foil with the gold cuttings. An addition of rose copper foil produces a red gold. The preparation is the same for silver powder employed for correcting slight defects in silver articles not exposed to friction. Gilders should always have these different powders at hand, as their use often saves considerable labour.

Electro-Gilding.—Gilding by the battery has two great advantages; it can be applied to all the ordinary metals, and the thickness of the deposit is entirely under the control of the operator. It is not always necessary in electro-gilding to use a battery, for the contact of two heterogeneous metals, especially if immersed in an acid solution, is quite sufficient to develop electricity; thus, if articles attached by zinc wires are plunged into gold baths prepared for the use of batteries, the gilding process will take place in the same manner as with a separate battery. It must therefore be understood that under electro-gilding, or, more generally speaking electro-deposits, we mean every application by means of an electric current, independent of its mode of production; but we shall describe more particularly the methods and formulæ which require electric generators separated from the bath.

There is a hot and a cold electro-gilding process; the latter is principally employed for large articles such as clocks, lustres, candelabra, &c., which would require the heating of large quantities of liquid; the hot process, on the contrary, is well adapted to small articles. We may state at once that with the hot gilding a deposit is obtained much smoother and cleaner and of richer colour than by the cold method; and the articles may often do without colouring after coming from the hot bath. There is an erroneous impression prevalent among industrials, viz., that gilding by heat is less resisting than gilding in the cold. We assert on the contrary, that for *equal quantities of gold* hot gilding is infinitely more solid than cold gilding. It is evident that a cold metallic surface plunged into a hot bath becomes dilated by the action of the heat, thus a larger surface is offered for deposit. On cooling, the surface shrinks back again, and the small and numerous particles forming an electric deposit are brought closer, an advantage which could not be obtained by the cold method. But the best proof that hot gilding is more solid than cold, lies in the fact that neither steel, nor tin, nor lead, can be gilt by the latter method. Finally, the hot baths have a tendency to dissolve any greasy bodies or oxides which may remain on the surface of the articles, and thus secure a successful operation.

(*To be continued.*)

BOOK NOTICE.

Monograms of three or more Letters. 1880. Trübner and Co., Ludgate Hill, London. Aitken and Fairie, Glasgow.

This is a handsome volume of three or more letter monograms designed and drawn on stone by Charles De Flandre, F.S.A., Scotland, with indices showing the place and style or period of every monogram, and of each individual letter. It consists of forty-two sheets, each containing nine monograms of original design. There are two sheets of A, in combination with other letters, two sheets of B, and so on throughout the alphabet, excepting the letters K, Q, X, Y, Z, which occur more rarely, and of which there is only one sheet. The volume will certainly prove very acceptable to designers, engravers, etc., and we recommend it to their special attention. We need hardly add that the work is got up in the best of style.

The unique collection of snuff-boxes formed by Mr. Charles Goding, of Knightsbridge, which has been on loan for some years at the South Kensington Museum, has been purchased by Messrs. Wertheimer, Bond Street, for the sum of about £40,000.

REPAIRING SWISS WATCHES.
No. III.

By H. GANNEY.

THE centre and third and third and fourth wheels are easily corrected by driving the third bridge in the required directions, as the third cock governs both depths. Either or both can be made deeper or shallower at pleasure. The barrel depth may be altered by driving in the same manner. We strongly advise the young jobber not to wait until a bad depth stops a watch before altering it, as it invariably injures the wheel teeth if shallow before doing so; but having a good idea of the right amount of shake, always endeavour to secure it by the ready means at disposal in all Swiss watches. Many jobbers are puzzled by the fact that many watches that come into their hands for the purpose of cleaning only, with a good character for past performance, will not go at all when cleaned and put together again. This arises from the depths having been set by forcing the cocks in the required direction with the pliers the last thing, and when unscrewed these resume their original positions. A watch is more likely to stop with a pinion too large than too small. A rough and ready way to size wheel and pinion is to gauge two or three teeth of the wheel with the pinion gauges, and see that the same number of leaves of the pinion have fair shake in the gauge. We do not give this as a scientific rule; if the jobber wants scientific rules to work with he had best change his vocation for manufacturing; and even then scientific rules, unless tempered by practical experience, will not answer all purposes, as shown by the theoretical objections to dispensing with the fuzee shown by English watchmakers of the present age, and the refusal of their predecessors on scientific grounds to use a steel wheel to propel a steel cylinder. These two ideas have nearly extinguished, we believe, the English watch trade. On the other hand we may ask the strictly commercial manufacturer if, in responding to the demand in large cities for articles for mere selling purposes, he is not killing real trade which is based on honesty and public confidence, and throwing into the hands of others who claim to work on plans which will not permit of much degradation the whole of the future trade in this art. At present his work is dependent on the watch jobber, who is fertile in expedients to secure some performance from even the most wretched trash the manufacturer can flood the market with. In Europe the jobber is always to be found to supplement with his wit, and not too particular dexterity, the want of accuracy and knowledge in the manufacturing and dealing portions of the trade. In America it was found that the average annual cost of keeping common watches in order was greater than their original price, and this led to the establishment of machine watch making, which now threatens to extinguish the demand for both watch makers and repairers, who are likely to be replaced by watch architects, machinists, and labourers; but as improvements only injure those who do not choose to adopt them, the concentration of the manufacture may also involve its extension. The original machinists of the Waltham Company have left the factory some years, and have been supplying machinery to all requiring it in America or Europe to run rival factories with. Mr. Dennison, the original founder of the American system at Waltham, has been in England some years, first as the originator of machine watch making at Birmingham, and for some time past making cases by machinery for American watches sold in England. Whilst our English case makers have been asking Parliament to prevent the Swiss case maker having his cases tested for quality at Goldsmiths' Hall, hoping to sweep a rival out of the market, Mr. Dennison is destroying the demand for Swiss cases by making what is wanted at the price, and maintaining the English trade and supremacy in that branch of trade. We know of several towns where the manufacture of watches is being developed, thanks to the facilities of Mr. Wycherly's system of uniform movement making, which allows other branches to work to recognised sizes, so that cases and dials can be ordered as wanted. The intelligent finisher and escapement maker who, on account of bad trade in Coventry or Clerkenwell, or a desire to gain wider experience and the ability to work in every civilised community, turns jobber, carries the seeds of a successful manufacture wherever he goes, and supplementing slack seasons at jobbing with new work, builds up a reputation for himself or the firm that engages him. I expect to see in the future a powerful antagonism between this system and the factory system, if there is intelligence enough in those who, following new work at home for a livlihood, are capable of moving with the times. The greater part of those connected with the English watch trade will never work in workshops other than their own, because it would involve a loss of the capital and social position they at present occupy; and the trade will either dissolve and evaporate as now conducted, or mutually co-operate to serve their own and the public interests. At present all are too antagonistic, and the bill-sticker is the most important factor in making and sustaining horological reputations in this country.

A thorough circulation of the ideas of the trade is the best correction of defects either of ignorance or arrogance. I have enlarged on the present style of watchmaking, as it is possible that this method will only be retained in the jobbing trade. The bow and turns, the old nail and bit of cork, ousted like the weaver's distaff from the weaver's hands as too slow for manufacturing purposes, will linger in the repairing shop, and by their adaptability to ever-varying requirements maintain their supremacy. A constant changing of tools and methods of work is as much to be deprecated as a refusal to adopt new methods. The jobber may make up his mind to use the most simple tools, and rely upon himself for their application, and also for their construction. I do not find purchased tools last long, and the ability developed in making tools is capital practice for their application. Punches and drills should never be bought. The ends of English pivot broaches we always used for making drills, and they are the only steel we found capable of drilling hardened and tempered steel, holding them in the flame of a candle (gas spoilt them), and then a rapid shake through the air hardened them, or they could be put in the candle itself quickly. This was the orthodox fashion, and other methods and drills may answer for other purposes; but this is the only drill we can depend upon for a good job, the ordinary Swiss drill being much too flexible and poor steel.

(*To be continued.*)

WHITBY JET TRADE.—We are glad to hear that this industry is looking up again. The jet ornament trade was once the staple industry of that town, but for many years past it has been in a very depressed condition. The greatest improvement is noticeable in the better class of goods, and we are informed that they are principally intended for shipment to France and America.

His Excellency the Siamese Ambassador and suite during their stay in this country determined to present to the King of Siam, as a memento of their visit, a copy in silver of the Albert Memorial. This work has just been executed by Mr. Benson, silversmith. It is said to be the largest architectural piece of plate ever made, standing 7 ft. high. The design has been somewhat modified to bring it into accordance with the Buddhist religion, but in general the lines of Sir Gilbert Scott have been followed. The figure of the Prince Consort has been replaced by that of the King of Siam.

ROBINSON (GOLDSMITHS' COMPANY) *v.* CURREY.

(Tried in the Queen's Bench Division on November 12th, before Mr. Justice Field and Mr. Justice Manisty.)

THIS was an action to recover penalties by the plaintiff, a member, and on behalf, of the Goldsmiths' Company, against the defendant, a silversmith, for the alleged counterfeiting of the Hall marks of the company. The defendant pleaded, amongst other things, a statute of limitations, and also that the plaintiff was not a "person aggrieved" within the meaning of the Act relied on. To these pleas the plaintiff demurred, and the argument of the demurrer was heard to-day.

Mr. Wills, Q.C., with whom was Mr. Coxon, supported the demurrer. The question to be decided turned upon the language of the Act 7 and 8, William IV., chapter 22, which was passed for the more effectual prevention of fraud in the manufacture and marking of plate. Section 5 of the Act provided that every dealer in gold and silver wares who should sell, exchange, or keep for sale, or have in his possession any gold or silver ware which had been altered or added to, the alteration or addition not having been assayed or marked, should for every such offence forfeit a certain prescribed penalty; and it was enacted that the penalties might be recovered by any of the several goldsmiths' companies of London, or of a number of other cities and towns which were named. The learned counsel contended that the penalties could be recovered by any one of the companies, even though the counterfeiting did not take place in the town, and was not the mark of the company by whom the action was brought. If it were otherwise, the London Hall mark might be imitated and the sale take place, without penalty, in Sheffield. Then as to the limitation of two years relied on in the plea, it only related to a "common informer," which the company suing was not. If it were otherwise, counterfeited articles might be kept back for over two years, and then sold with impunity.

Mr. Justice Field inquired whether the articles the subject of the action were portions of the Queen Anne's silver of which they had read so much lately.

Mr. Wills replied that such was the case.

Sir John Holker, Q.C. (with whom was Mr. Crumpe), contended that the plea was good, and was a bar to the action. Rightly or wrongly, the statutes limited the right to sue for penalties to two years from the committal of the offence alleged, and the plaintiff could not succeed, not being "a party aggrieved," because if the articles in question had been brought to the Goldsmiths' Company to be assayed, they would not have been marked, and therefore no fee would have become payable. The Goldsmiths' Company stood in the same position as an "informer," and statutes of Elizabeth and of Henry VIII. barred the bringing of actions for penalties by informers after the lapse of one year —a limit which was extended by the Act relied on by the defendant to two years.

After a lengthened legal argument,

The Court reserved judgment.

Judgment was delivered on the 17th ult. by Mr. Justice Field. Having stated the facts of the case and the Acts referred to in the argument, his lordship said he was clearly of opinion that the plaintiff, as representing the Goldsmiths' Company of London, was a person aggrieved within the meaning of the statutes, but that the action was barred by the limitation provided by the statutes.

Mr. Justice Manisty concurred.

Judgment was accordingly given for the defendant.

CITY AND GUILDS OF LONDON INSTITUTE.

MR. F. J. BRAMWELL, F.R.S., presided at a meeting of the Governors of this Institute, held at Goldsmiths' Hall, when Mr. Magnus, the director and secretary, read a report, which stated that the Institute had obtained from the Commissioners of the Exhibition of 1851 a plot of ground for a site for the future technical college in Exhibition Road, South Kensington. The plot had a frontage of 300 feet, with a depth of 110 feet, to be increased if required. It was granted for 999 years at the nominal payment of 1s. a year. The services of Mr. Waterhouse, A.R.A., the architect of several of the adjoining buildings, had been secured, and he would at once prepare plans for the contemplated building for presentation to the council. It was hoped the building might be begun before the second annual meeting.

Colonel Britten moved, and it was resolved, to appropriate £5,000 to the central building, as well as a further £5,000 for the wing for laboratories for the Cowper Street Middle-Class School.

The Drapers' Company, it was stated, had contributed £10,000 towards the City and Guilds Technical College, Finsbury, and other contributions were named from other guilds to warrant the council in proceeding with the erection of the central buildings. The technological examinations had been transferred to the Institute by the Society of Arts, and the students were increasing.

From the returns received at the Central Office, it appears that 2,250 artisan students are at present receiving instruction in different parts of the kingdom from registered teachers of the Institute in various branches of Technology. Compared with the returns of last year this number shows a remarkable increase. Of the 816 candidates who presented themselves for examination in May last, only 595 had received class instruction. As the examinations to be held on May 25th and May 26, 1881, are open to all students, whether they have been taught in classes connected with the Institute or elsewhere, it is expected that nearly 3,000 candidates may present themselves at the next examination. By means of these examinations, and the payments made to teachers on behalf of successful candidates, this Institute is practically subsidising Technical Education in all parts of the country.

The Chairman stated that in a recent tour he had made in Switzerland, he had visited with much interest and admiration the Polytechnic Institution at Zurich, a technical university on the largest scale, and most efficient in all its arrangements. With an income of £18,000 a year, a most comprehensive education was given to more than 4,000 students, including natural science, the special application of science to all the branches of manufactures, and especially the cultivation of a taste for beauty as applicable to art manufactures.

Sir John Bennett moved, and Sir Sydney Waterlow seconded, and it was resolved, that copies of the report should be forwarded to members of the Courts of the London Companies, and also to the members of the Corporation, from whom a large amount of support to the funds was confidently calculated on.

Alderman Sir Sydney Waterlow, M.P., was unanimously elected treasurer.

Sir John Bennett has given notice of his intention to move at the next meeting of the Court of Common Council that a grant of £10,000 be made in aid of the objects of the institute.

GREENWICH CHRONOMETER TRIALS, 1880.

FORTY-FOUR chronometers (thirty last year) were rated this year at the Royal Observatory, Greenwich. The trials lasted the usual period of twenty-eight weeks, from January 10th to July 24th. During four weeks from the 28th February, and during four weeks from the 15th May, the chronometers were placed in the chamber of a stove heated by jets of gas. The lowest temperature in which they were tried was 24° Fah., the highest 103° Fah. The five chronometers enumerated below rank first:—

No. 5,658, by Cornell, 74, Bank Street, Maidstone (balance with Airy's compensation adjustment).

No. 3,970 by Kullberg, 105, Liverpool Road (palladium spring, without auxiliary).

No. 3,000, by Matheson, Shore, Leith (auxiliary to balance, with Airy's compensation adjustment).

No. 2,767, by Johannsen & Co., 149, Minories, E. (continuous auxiliary to balance, acting in both extremes).

No. 3,976, by Aitchison, 15, Bank Street, Edinburgh (auxiliary with Airy's compensation adjustment).

The rates of these chronometers were as follows:—

Least Weekly Sum.	Temperature.	Greatest Weekly Sum.	Temperature.	Difference between the Greatest and Least.	Greatest difference between one week and the next.	Extremes of Temperature during these weeks.
—0·3 s.	89° to 100° F.	+16·0s.	64° to 76° F.	16·3 s.	3·7	80° to 99° F.
+2·8 s.	24° to 56° F.	+17·7s.	68° to 74° F.	14·9 s.	4·4	46° to 98° F.
—10·0s.	38° to 57° F.	+ 3·9s.	68° to 74° F.	13·9 s.	5·6	49° to 63° F.
0·0 s.	65° to 98° F.	+11·4s.	68° to 74° F.	11·4 s.	8·0	46° to 98° F.
+3·5 s.	49° to 56° F.	+16·5s.	85° to 99° F.	13·0 s.	7·9	59° to 99° F.

Diamonds in New York.—The *New York Sun* says:—"One of the largest purchases of diamonds ever made by a private buyer for personal use has been made by a member of the English nobility from a New York house. The negotiations began months ago. The nobleman, who may be called the Earl of A., had long been anxious to get a diamond necklace which should be an exact fac-simile of the one worn by the Empress of Russia at the time of her daughter's marriage to the Duke of Edinburgh, but the prices charged by the London, Paris, and Amsterdam dealers were far too high to suit the Earl's purse. The Czarina's necklace cost 820,000 dollars; and although the price to a private person would have been less (since royalty always pays 100 per cent. in excess of staple prices), still the Earl could not get what he wanted at a price he could afford to pay. As it is now a number of years since the Duke of Edinburgh's wedding took place, it may be granted that the Earl had nearly given up hoping to get the necklace. Last year, however, while at a reception by Mrs. Mackay in Paris, the nobleman mentioned his desire to possess a duplicate of the Czarina's necklace; whereupon Mrs. Mackay suggested that he would succeed better in New York than elsewhere. She mentioned the fact that her own elegant diamonds would have cost far more in London than she paid for them in New York. Subsequently the Earl, having heard of another large purchase of diamonds by a wealthy family of Manchester, England, was led to ask this house to make an estimate of the cost of such a necklace as he wished. To his astonishment the firm offered to supply it for less than £25,000, or about 125,000 dollars. After considerable negotiation, to insure that in size and quality the gems should be equal to those in the Czarina's necklace, the order was given. The necklace has just been completed, and is kept in the firm's safe until the head of the house takes it to London. It consists of fifteen magnificent brilliants graduated from about the size of a filbert to the central stone of three times that size. The total weight of the 15 stones is 640 carats. They are linked together by a nearly invisible setting, so that, as they lie on their bed of black velvet in the case, there is nothing to detract from the matchless brilliancy of the diamonds themselves. Even in the dim light of the safe in which they are kept they shine like so many bright stars. In viewing them at any angle their fire is as marked at one time as at another, so perfect are their proportions and so faultless the cutting. Besides the necklace are ear-rings and a brooch. The ear-rings are solitaires, weighing 26 carats each, in exact harmony, as to colour and shape, with the great stones of the necklace. The brooch is made to imitate one of the heraldic emblems of the Earl's coat of arms. It contains seven large stones, weighing 144 carats, and sixteen smaller diamonds, weighing 60 carats. The cost of the ear-rings and brooch is 35,000 dollars. The whole set, valued at 160,000 dollars, will soon be taken to England, and the name of the purchaser will then be made known."

SOUTH KENSINGTON MUSEUM.

WE are officially informed that the director of this institution has just returned from an official visit to the museums and to the Imperial and other collections of St. Petersburg and Moscow, undertaken by desire of the Lord President of the Council, in order to ascertain what examples of gold and silver smiths' work in these collections might be reproduced to add to the large number of *fac-similes* of art treasures, both English and foreign, already existing at South Kensington. The good offices of Lord Granville and the English Embassy at St. Petersburg, as well as the strong personal interest in the success of this mission evinced by Prince Lobanoff, the Russian Ambassador, secured for Sir Philip Cunliffe Owen and the experts who accompanied him (Mr. Soden Smith, of the South Kensington Museum, and Mr. Wilfred Cripps) a most cordial reception. The Emperor ordered unreserved compliance with the request for permission to copy in electrotype from objects in the Imperial collections. Every facility was offered for the examination of the contents of all storehouses or cabinets, however secluded from ordinary inspection, in the Winter Palace, the Hermitage, the Arsenal at Tsarkoe Selo, and the Kremlin; while the treasuries of churches, including the Troitsa Monastery and the private collections of several connoisseurs, were freely opened.

A selection was made of about 250 objects, ranging from goldsmiths' work of early Greek art exhumed at Kertch, through mediæval times, to English plate of the 16th and 17th centuries, and excellent pieces of French art of the period of Louis XV.

Provincial museums and local art exhibitions are largely interested in the advance of this branch of the operations of the museum, by which *fac-similes* scarcely distinguishable from the unattainable originals are either lent on loan or may be purchased, at a very moderate cost, for permanent display at the chief centres of industry throughout the country.—*Daily Telegraph.*

STATISTICS FROM THE BIRMINGHAM ASSAY OFFICE.

THE number of gold and silver watch chains assayed and marked is about three hundred each office day.

During the past seven years the silver work has increased year by year until it has nearly doubled.

The number of gold and silver wares entered has for some years past exceeded a million annually.

During the past seven years 18,722 ounces of gold and 4,846 ounces of silver have been assayed and broken, being found to be worse than standard.

ON THE FLUCTUATIONS IN THE RELATIVE VALUES OF SILVER AND GOLD, WITH SPECIAL REGARD TO THE PRESENT DEPRECIATION OF SILVER IN INDIA.*

By Edward J. Watherston.

(Continued from page 54.)

Thus it will be seen that the fluctuations in the respective values of the two precious metals were constant in the Middle Ages, while at the same time revolving around the figures of 10 to 1. It seems as if there had been for a great many centuries an inherent belief in mankind that the two metals, having once been adopted as mediums of exchange and standards of treasure, the one should be considered ten times as valuable as the other. It was really a very reasonable view, and it would have been for the benefit of commerce had this ten to one standard taken firm possession of the minds of mankind.

It was the conquest of South America which overthrew the old-world notions respecting the relative values of silver and gold. The effect of past imports of silver from Mexico and other states of South America was first felt in a fall of its value in Spain and Portugal, and from thence it spread over the other countries of Europe. In England the fall in the value of silver was very sudden. While in the forty-second of the reign of Queen Elizabeth, the year 1600, the relative value of silver and gold stood as 10½ to 1, it had risen five years after, in the third year of the reign of James I., to 12 to 1, and in another five years to 13 to 1. It remained in this proportion until about the year 1620, when a fresh decline in the relative value of silver set in, the respective figures reaching 14 to 1 in 1660; 15 to 1 in 1695; and 15½ to 1 in 1716 the second year of the reign of George I. The head of the government at this period, Robert Walpole felt alarm at this great depreciation of silver, and to discover the causes, with possible remedies, he instituted a Royal Commission, at the head of which was placed the great Sir Isaac Newton, acting for the time as Master of the Mint. Sir Isaac presented a lengthened report, dated September 21, 1717, in which he strongly recommended that, for the future, the relative value of silver, in all coinage operations, should be fixed at a fraction over 15 to 1. The exact figure he gave was 15·096 to 1. Sir Isaac Newton arrived at this figure by carefully inquiring into the relative values of silver and gold all over the world. He found, he said in his report, that in all the states of Europe the relative value of silver and gold was between 14½ and 1 and 14 and 1, while in India, China, and Japan the proportion was from 12 to 1 to 11 to 1. It was in order to prevent the exportation of silver from England (a favourite theory in those days) to foreign countries and British possessions that Sir Isaac Newton recommended the standard of 15 to 1. The great philosopher, for various reasons, set a high value upon the country possessing a silver currency. For a century all English statesmen followed his example, and silver became the legal standard money of the realm.

It was through an extraordinary combination of circumstances that the silver standard was suddenly abolished in 1816, and that of gold substituted for it. The terrible expenditure of the wars against Napoleon had thrown the finances of England into the greatest disorder. It was computed that the total cost of those wars to the nation amounted to not less than 1,500 millions sterling, exclusive of large grants to Austria, Prussia, and Russia. Although taxation has been pushed to its extremest limits to provide for the monstrous war expenditure, a great portion of it had to be supplied by means of loans, which more than trebled the amount of the national debt. While at the commencement of the first war against France, in 1793, the total debt was £239,350,000, and the interest £9,208,500, the debt at the end of the wars, after the battle of Waterloo, had risen to £840,850,500, and the annual interest to £32,038,191. This fearful increase in the national burthens produced universal misery. To stop the drain of gold and silver from the country, the "Great Insolvent Act" was passed by Parliament in March, 1814, the doctors in finance alleging that national poverty and general stagnation in trade and commerce could be cured by the issue of immenso quantities of paper money. But a few years sufficed to show that the specific only aggravated the disease. There was widespread distress in all parts of Great Britain and Ireland, which led to riots, to be crushed only by the employment of soldiers, and consequent bloodshed. Then it occurred to the political and finance doctors that another remedy might be tried upon the patient—the nation. It was admitted that the creation of a depreciated paper currency had done no good, and that it would be well that metallic money should again be adopted. To achieve this, a most singular, and not more singular than irrational, expedient was hit upon. To restore the metallic currency, it was deemed wise to banish the most important part of this currency from the land. Silver had been, hitherto, a legal tender, and now by an Act passed June 22nd, 1816, gold was substituted for it in payment for sums over forty shillings. The effect of this piece of legislation, in which England stood alone, was simply to deprive the country, once and for all, of a medium of exchange of over a hundred millions sterling. From a common-sense point of view such legislation now seems insane. Common-sense and high statesmanship, however, are known to be not always synonymous. There are still numbers of men, learned and unlearned, among us, who hold the legislation of 1816, which "demonetised" silver, and thereby contracted the metallic currency, to be a piece of very high statesmanship!

"You may hate inanimate things as you hate men," says an old Persian proverb. It almost appears as though this were the case with silver among us. Of all the metals, silver alone is taxed in England; of all the metals, silver alone is subject to restrictions in manufacture, to supervision, and to what may justly be called *espionage*. A foreigner might well conclude that the English people, or at least those who legislate for the people, hated silver, and attempted by all means in their power to drive it out of the country, and to prevent its manufacture into articles of use and ornament. It is barely in any other way that we can explain, or account for, such absurd laws as those bearing on the taxation of silver plate, and the system of compulsory "hall-marking." It puzzles the mind to understand why silver, in whatever form should be taxed any more than gold, copper, iron, tin, or other metals; and it is not less a puzzle to comprehend why articles of silver should be "hall-marked," that is, impressed by certain stamps, to every one of which there is a reasonable objection, and thereby generally disfigured. If it be affirmed that the said "hall-marking" is a security for the buyer, that he gets an article of a certain fineness and value, then the argument must be pushed further, and all righteous men will have to insist that every article of general consumption, or in general use, should be "hall-marked." We know to our cost that many a coat professedly made of good woollen cloth is merely of "shoddy"; we know that "silk" is often more the product of the cotton field than of the silkworm, and that its weight is more to be attributed to scientific loading than to the raw material; we know that ladies' ornaments openly sold as "pure gold" and "fine gold" may contain only one third of the precious metal, and even less.

(To be continued.)

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* A paper read at the Social Science Congress, Edinburgh.

ABUSES IN THE AMERICAN JEWELLERY TRADE.

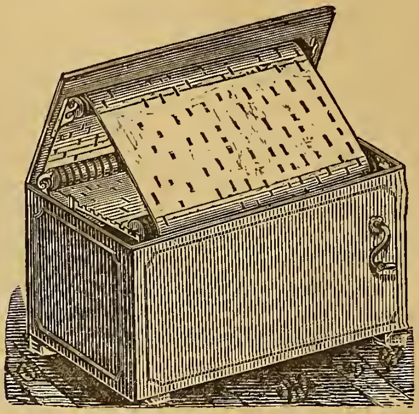
FROM articles which have appeared from time to time in our American contemporary the *Jewelers' Circular*, it appears that certain members of the jewellery trade in that country are not very scrupulous in their dealings, and that to sell 10 carat gold for 14, and to stamp 14 carat for 18 fine, is quite a common practice. Our authority, in speaking of these nefarious practices, says:—"The true remedy for abuses of this character is the adoption of a standard of quality, and the imposition of severe penalties for the manufacture of goods that are below the grade represented. In order to do this, it is necessary for the Government to establish a standard for wrought gold, specifying the number of carats that shall constitute pure gold, and to what degree it may be alloyed and still be merchantable as gold. Of course, if the English standard should be adopted, providing that 24 carats constitute pure gold, then metal degraded below 12 carats would cease to be gold, but would be classified as base metal. This would rule out of the trade a vast amount of cheap and worthless goods. But to purify the trade entirely, it should be provided that every manufacturer should either stamp upon his goods the quality of the gold of which they are made, or certify to the quality in some way; and any false stamping or false certificate should constitute a misdemeanour, punishable by fine and imprisonment. As an incentive to the prosecution of fraudulent manufacturers, informers should be entitled to one-half the fine collected from persons against whom they give information. This would soon break up the practice of stamping 14 carat goods as 18 carats fine, or selling 10 carat goods as 14 carat. The stamp or certificate of quality should be exacted of every manufacturer, and in every case where the stamp or certificate was fraudulently given, severe penalties should be inflicted. For the purposes of Government interference, a bill of sale should be constructed as a certificate of quality. In this way, and in no other that we can conceive of, can these fraudulent practices in the jewellery business be prevented. While a majority of the trade are honestly inclined, selling their goods for just what they are, there is still another class that relies upon the ignorance of the public to enable them to palm off as genuine gold goods articles that have been so degraded as to have lost the right to be called gold—the semblance may be left, but the value has been destroyed.

*It would not be feasible to introduce here the system of hall-marking that prevails in England, as it is open to many objections;** but it is feasible, and entirely within the province of Congress, to establish standards for wrought gold, and to provide penalties for anyone selling goods of a quality inferior to the standard represented. There is a class of men who pride themselves upon successfully deceiving the public. This can only be controlled by the strong arm of the law. At present they are under no restraint whatever, and, consequently, the jewellery trade suffers from their swindling transactions. It is high time the law was invoked to suppress them and their nefarious business.

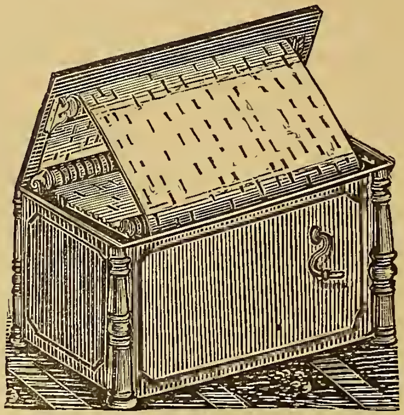
IMPROVED PATENT MUSICAL BOXES, ORCHESTRIONETTES, ETC.

(Patent, Paul Ehrlich, Gohlis-Leipzig.)

A FULL and illustrated description of this excellent invention appeared in our Journal for July, 1879, and, as we then predicted, the system has met with universal approval. The business grew so rapidly that Messrs. Ehrlich and Co. were obliged to considerably increase their manufacturing power and to call in the assistance of capitalists; this resulted in the formation of a company under the name Fabrik Leipziger Musikwerke. A large and well-appointed factory has just been completed for the company, so that they will now be able to satisfy the heavy demands made upon them.



The great advantage of Ehrlich's system is that it does away with the costly "pinned barrel," and that its playing from note-sheets does not limit the number of airs as in the ordinary musical-boxes; all that is required is the insertion of a fresh note-sheet. These note-sheets are no more expensive than ordinary music-sheets, and the favourite airs of any country are supplied by the manufacturers. Note-sheets for any music not in stock are supplied on demand at slightly increased prices. The process of preparing these sheets, which are also patented in every country of Europe and America, is very simple.



The notes of the selected piece are transcribed on a piece of ordinary paper, the same size as the sheet to be used for the instrument; from this paper they are autographically transferred to the music-sheet, and the latter is finally passed under an ingeniously constructed stamping machine which cuts the notes out. The *crescendo* and *diminuendo* is obtained by a clever variation in the shape of the perforations, and the pins of the tongues have for the same end several corresponding gradations. According to the depth the pin enters the "grooved" barrel (which takes the place of the "pinned" one in the ordinary system), the tongue is more or less raised, and consequently the sound produced varies in duration and power.

One of these instruments, submitted to our inspection some time ago, certainly surpassed in simplicity and solidity of make, as well as pureness of tone, anything we have previously seen; that is, taking cost into comparison. We are informed by the company that any infringement of their patents will be rigorously prosecuted.

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* The italics are ours.—Ed.

THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.*

By M. Grossmann, Watch Manufacturer,
Glashuette (Saxony).

(*Continued from page* 55.)

54. Another matter of great importance is the uniform transmission of motive power from the barrel through the train to the escapement. This uniformity can only be attained by good depths; and as it is well known that the depths are more perfect with the higher numbered pinions, it is advisable never to have the centre pinion with less than 12 leaves, the 3rd and 4th wheel pinions with 10, and the escape pinion with 7 at least. The difference resulting therefrom in the cost of manufacturing is so very trifling that it could not be an obstacle to making even low-class watches with these numbers.

The centre pinion, it must be admitted, will be more delicate, apparently, and more liable to injury by the sudden jerk resulting from a rupture of the mainspring, or by the pressure occasioned through careless winding. The teeth of the barrel, too, being necessarily thinner, will be more apt to bend from the same causes; but this is partly remedied by the fact that with a pinion of twelve there are in almost every moment, two teeth of the barrel acting at the same time on two leaves of the pinion, while in the lower-numbered pinions one tooth alone has to lead through a more or less extended angle. Thus, any sudden shock will be divided between two teeth of the pinion of twelve, and sustained in the same way by two teeth of the barrel belonging to it, whereby the apparent danger is greatly diminished. Besides, the finer toothing producing a better transmission of power, a weaker mainspring may be used, and in case of its rupture the shock will be less violent.

55. One of the chief conditions for a good and regular transmission of power is a good and suitable shape of the wheel teeth; and it is astonishing to see in what an indifferent way this important matter is treated. It is a well-known fact that the wheel-teeth, in order to act properly, ought to have an epicycloidal rounding, and no engineer would suffer any other form for the teeth of star-wheels. Berthoud treated this subject in a most elaborate way about a century ago; Reid and others have also explained the principles of the construction of toothed wheels most explicitly, but in vain. It seems that the greater part of the horological community have resolved to view the shape of their wheel-teeth as a matter of taste. All the wheels of English and other makers have, with very few exceptions, their teeth of a shape defying the rules of Berthoud, Reid, and other masters—a shape of which nothing can be said, except that they look very nice in the eyes of those that make them, or those who use them, and say "They look much better, indeed, than those ugly pointed teeth."

There is no possibility of being successful against arguments like these, and I have known many a respectable and good watchmaker who declared that he could not bear the sight of epicycloidally rounded teeth. This is a subject, however, which can not be more amply entered into in the present essay.

56. The respective proportions of the wheels of a train ought also to present a certain harmony, attainable by a regular progression in the diameters of the wheels and the fineness of their teeth.

57. With respect to the escape pinion, at least for the larger watches, I would strongly recommend to have it of eight leaves, with a fourth wheel of 75, and an escape wheel of 16 teeth. The last depth, the most sensitive of all to any irregularity of transmission, will be found greatly improved by so doing.

58. The following are the sizes of a train, which, according to my opinion, would answer perfectly to the above conditions, for a watch of 43 m. = 19 lignes Swiss, or 14 English size:—

Diameter of barrel (§25) 43 × 0.485 =	20·85 m.
Centre wheel	15·4 m.
Third wheel	13·0 m.
Fourth wheel	11·8 m.

The numbers would be:—

Barrel	90 teeth.	Pinion ...	12
Centre wheel ...	80 ,,	,, ...	10
Third wheel ...	75 ,,	,, ...	10
Fourth wheel ...	75 ,,	,, ...	8
Escape wheel ...	16 ,,		

The sizes of teeth are accordingly:—

Barrel	0·345 m.
Centre wheel	0· 30 m.
Third wheel	0· 27 m.
Fourth wheel	0· 24 m.

It is easy to see that this progression is a very regular one.

59. The train ought to be arranged in such a way as to have the seconds circle at a suitable place on the dial. This circle, of course, ought to be as large as possible, for the sake of distinctness of the divisions, and, on the other hand, it ought not to be so large as to cover entirely the VI. of the hour circle. It may be recommended as a good disposition to have the centre of the circle of seconds exactly in the middle of the distance from the centre of the dial to its edge. The general observation of this rule would be a decided step towards a greater regularity of construction, and besides, it would prove a great boon to all the dealers and manufacturers of dials, and to all the repairers who have to replace broken dials.

A greater circle of seconds might be obtained by approaching its centre nearer to the centre of the dial, but this subordinate advantage would be too dearly purchased at the expense of the commodious arrangement of the wheel-work.

60. The height of the moving arbors ought to be restricted only by the height of the frame. The longer the distance between the two bearings of an axis can be, the better it will prove for the stability of the moving part as well as its performance. The same amount of side-shake required for free action will influence the pitch of a long pinion less than that of a short one.

The diameters of the pivots in watch-work could not be made according to the generally established rules in the construction of machines, for if we should attempt to make the dimensions of our pivots in a theoretical proportion to the strain which they have to resist, we would obtain pivots of such extreme thinness that they would be very difficult to make and to handle, and it would be doubtful whether the cross section of such a pivot would not come into an unfavourable proportion with the molecular disposition of the steel. Besides, it ought always to be kept in mind that the pivots of the train must not be calculated to bear with safety the mere pressure of the mainspring, but also the sudden strains resulting from rupture of the spring, or from rough winding. Thus, there will be very little to say against the way in which the pivots of watch-work are generally made.

(*To be continued.*)

Special Notice.—Thanks to the continually increasing patronage bestowed on us by the trades we have the honour to represent, we are enabled to enlarge the size of the paper by one-third. The first number of the enlarged series will appear in January next.

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LECTURES ON WATCH AND CLOCK MAKING,

PREPARATORY FOR THE ELEMENTARY EXAMINATION OF THE CITY AND GUILDS OF LONDON INSTITUTE IN MAY, 1881.

DELIVERED AT ST. THOMAS CHARTERHOUSE SCHOOL BY I. HERRMANN, ON MONDAY EVENINGS FROM OCTOBER 25TH.*

THE section on watch and clock-making in the programme of the City and Guilds of London Institute,† forms a synopsis of horological technology.

To the candidate for the above examination it answers a twofold purpose: it forms a guide for his studies, and, being compiled for the object of giving the best possible practical benefit, it is a guarantee that it will give him all the advantage that can be obtained in the pursuit of technology.

In paragraph 1 we have the various principles in mechanics which enter into calculations in watch and clockmaking.

Then paragraph 3 applies to great works of clocks and watches.

In 4 and 5 we have an exhaustive summing up of the conditions involved in depths.

From paragraph 6, which treats exclusively of escapements, we have the remaining four relating to the principles of pendulum, balance and balance-spring, and timing. This, of course, comprises the subjects for the whole of the three grades, viz.:—elementary, advanced, and honours.

An approximate guide as to the elementary section is furnished by the examination paper of last May.

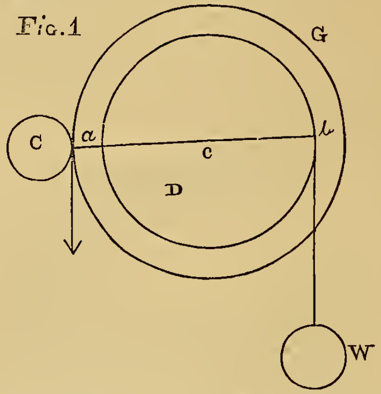
Question No. 1 will test how far the student is acquainted with terms and abstract principle, to which Nos. 4, 7, 8, and 10 form the problems. Five and 6 deal with "force reserve" during winding of any watch or clock; and 2 and 3 with trains.

Questions 9, 11 and 12 relate entirely to escapements. Within a certain limit this paper is complete, and the young man who has the necessary knowledge to answer all these questions will often escape difficulties which otherwise would beset him.

Our mode of proceeding will be this:—We shall follow the course suggested by the above paper, and thus start with the great works of clocks and watches; analyse the conditions and principles involved, and define the terms employed.

We will take the simplest form, that of an English eight-day clock or regulator.

FIG. 1



Let D (fig. 1) represent the drum or barrel of a clock, on the circumference of which the line is coiled by which the weight is suspended.

Let G be the pitch circle of the great wheel in contact with C, the pitch circle of the centre pinion at *a*; then c *b* is the radius of the drum or barrel, and c *a* the radius of the pitch circle of the great wheel; from *b* a weight, W, is suspended.

Then what is the energy of the great wheel, or circumferential force, at point *a*, where it is in communication with the centre pinion, C, and the amount of pressure on the centre of motion or pivots at c?

Before we proceed to investigate this, we will make ourselves acquainted with the ideas which the terms we have used represent.

DEFINITIONS.

A circle is a plane figure enclosed by one line, which is called the circumference; it is such that all lines drawn from a point within the circle to the circumference are equal.

This point is called the Centre; and any line drawn from the centre to the circumference is called the Radius.

The Diameter of a circle is a straight line drawn through the centre, and terminated by the circumference.

The Pitch Circle is a circle drawn through those points of the teeth of a wheel where the straight faces of the teeth

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† City and Guilds of London Institute for the Advancement of Technical Education.—Technological Examination.—Watch and Clock Making:—

The examination will include questions founded on such subjects as the following, but will not necessarily be confined to these subjects:—

1. Mechanical and physical principles that have a bearing on watch and clock-making—"Force, power, resistance, velocity, inclined plane, lever, resolution of forces, laws of falling bodies, inertia, momentum, percussion, volume, mass, density, weight, friction, adhesion, moment of inertia, centre and radius of percussion, radius of gyration, etc."

2. The selection of metal for use in horological mechanism. Characteristic properties of metals that determine their adaptability to different uses. Hardening and tempering.

3. Prime movers; weights and springs; means of rendering motive force uniform. Stopworks and maintaining powers; remontoires.

4. Depths. Conditions of uniform lead. Calculation of number of revolutions and vibrations per hour. Trains of clocks and watches.

5. Forms of teeth. Epicycloidal and involute teeth. Relative dimensions of wheels and pinions in a given train.

6. Detached and undetached escapements. Principles of action of the several escapements in common use, with conditions to be satisfied for efficient timekeeping. The cylinder, lever, and chronometer escapements, with some account of the advantages of each. Pin and gravity escapements for clocks.

7. Simple and compound pendulums. Law of their movement. Relation of length to period of oscillation. Conical pendulum. Conditions of isochronism in stationary clocks.

8. Annular balance and balance-spring. Conditions of isochronism in portable timekeepers. Timing.

9. Theory of compensation in pendulums. Considerations that guide in the selection of a pendulum. Barometic error in clocks.

10. Compensation in watches and chronometers. Action of ordinary compensation balance and source of error at temperatures other than those for which the adjustment has been made. General principles on which it has been proposed to correct this error. Mode of adjusting compensation. Tabulation of errors.

Elementary Examination Paper.—1. What do you understand by the terms radius, circumference, depth, potence, escapement, recoil?

2. How is the minute hand caused to rotate twelve times during each revolution of the hour hand?

3. A lever watch has the following train:—

Centre	wheel,	80	teeth.		
Third	,,	60	,,	with pinion of	10 leaves.
Fourth	,,	54	,,	,,	8 ,,
Escape	,,	15	,,	,,	6 ,,

Determine (1) the number of revolutions of the fourth wheel in an hour, and (2) the vibrations of the balance in the same time, showing the stages of your calculation.

4. How is it that the movement of a pendulum clock is maintained, although it is unprovided with a balance-spring, which is essential in a watch?

5. Why is there no maintaining power in a going barrel watch?

6. Explain any device for maintaining the movement of a watch or clock during the time of winding.

7. Explain the mode in which the stopwork applied to the ordinary going barrel acts.

8. Describe the douzième gauge, explaining the mode of using it.

9. Why is it necessary that, in the ordinary lever watch, pins should be fixed in the plate to limit the movement of the lever?

10. Account for the fact that a fusee is often used in spring clocks, but never when the motive power is obtained from a weight.

11. What is the difference between a detached and undetached escapement? Give an example of (1) the dead-beat detached escapement, and (2) the dead-beat undetached, or frictional rest escapement?

12. What is the object of the pin fixed in the circumference of the balance of a cylinder escapement?

end, and the curves of the addendums begin, or through that point in the line of centres of a good depth, where the contact of a tooth and the corresponding pinion leaf commences. (This definition is in anticipation of the subject on depths, when it will receive further attention.)

The Lever.

The conditions of power communicated to centre pinion at *a*, and pressure on the centres or pivots, c, are given or found by the principles of the lever.

Definition.

The simplest form of a lever is a straight rod, which is considered or supposed inflexible, resting on a fixed point somewhere in its length, about which it can turn freely, and having two forces applied at two other points of this rod.

This fixed point is called the fulcrum, one force is called the power, and the other the weight. The distances of the points of application of the power and weight are called the lever arms.

A force is any phenomenon which tends to or resists motion, and any force which moves a given mass with a definite velocity is called a power, in other words it is a known force.

There are three kinds of levers, according to the relative positions of the fulcrum, weight, and power.

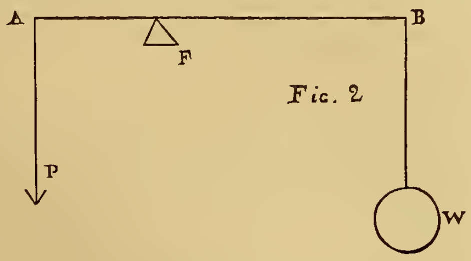
In the lever of the first order, or kind, the fulcrum is between the power and weight.

In the lever of the second order the weight is between the fulcrum and the power.

In the lever of the third order the power is between the fulcrum and the weight.

The effect of the power or weight to turn the lever about its fixed point or centre of motion is called the statical moment, and is proportioned to the unites of the weight or power multiplied into the distance of its application from the fulcrum.

There is equilibrium, or the effects of power and weight are balanced, when both moments are equal, that is, when the weight × by the lever arm from which it is suspended is equal to the power × by the lever arm on which it acts. In levers of the first order the pressure on the fulcrum is equal to the power plus the weight, and in levers of the second and third order it is equal to the difference of power and weight.



Fic. 2.

Examples.

Fig. 2 represents a lever of the first order. F is the fulcrum, W the weight, and P the power; F A the lever arm of the power, and F B the lever arm of the weight.

The moment of P and W will be equal when the ratio of the lever arms and the weight and power are equal.* Hence, when we know three quantities we can find the fourth by a proportion.† Let—

F B (Fig. 2) ... ... = 6
F A ... ... = 4
W ... ... = 8
P ... ... = x*

Thus since the weight is applied on the longer lever arm it must be less than the power; hence x will be a quantity or magnitude greater than W. It is necessary to notice this, as it will guide us for arranging the first and second terms of the proportion. Thus the short lever arm is to the long one as weight (here the lesser) is to the power, that is—

$$4 : 6 :: 8 : x$$

then—

$$x = \frac{6 \times 8}{4}$$

$$= \tfrac{48}{4} = 12 = \text{the power.}$$

We have thus—

$$4 : 6 :: 8 : 12$$

and—

$$\tfrac{4}{6} = \tfrac{2}{3} = \tfrac{8}{12} = \tfrac{2}{3}$$

therefore an equality of ratios.

In the same manner we can find the length of a lever arm if the weight and power are known. Thus let F A be the unknown magnitude = x. Since P is greater than W it must be applied at the shorter lever arm; hence we make the greater force, P, the first term, and the lesser, W, the second term of the proportion. That is—

$$12 : 8 :: 6 : x$$

then—

$$x = \frac{6 \times 8}{12}$$

$$= \tfrac{48}{12} = 4 = \text{the shorter lever arm.}$$

Since both forces (power and weight) act in the same direction, the pressure on the fulcrum is equal the weight plus the power = 12 + 8 = 20.

The same conditions apply to a lever of the second and third order, except the pressure on the fulcrum.

(*To be continued.*)

The Origin of the Diamond.—M. J. A. Roorda Smith has in the *Archives Neerlandaises des Sciences Exactes* a paper on the diamond mines of South Africa. He states that the diamond is found in a primitive gangue of volcanic origin, the presence of a double carboniferous silicate being a characteristic of these mines, which he regards as extinct craters of volcanoes. His hypothesis is that the diamond is of Plutonic origin, formed at the expense of organic matter under the influence of great pressure and at a high temperature. The recent artificial production of the diamond appears to confirm this view.

Colonial Visitors.—Many are the privileges of Colonists visiting the old country, and we should be the last person in the world to wish to curtail them; but even our guests from Australasia and Canada must be made to understand that the English palaces used as Royal residences are the private property of her Majesty. A Canadian recently writing to Toronto from London, speaks of the "tremendous amount of wire-pulling" going on, and the subserviency to the powers that be. "I desired to see the private apartments and the gold plate, because both are considered wonders of beauty and workmanship; but there was as much fuss as if I wanted to besiege her Most Gracious Majesty. What with writing to one person and calling on another, I was sick of the whole matter; and yet everyone says I was very fortunate, for I got permission the day after asking, and people are generally kept waiting a month. The gold plate is valued at 15 million dollars, and the china and pictures and various other odds and ends in the Queen's private rooms are simply priceless. One footstool is worth £30,000 sterling—it is a gold tiger's head with jewels encrusted. One vase cost ten thousand guineas, and a malachite vase as much, if not more. On the whole, you may say that Windsor is a nice little homestead for the House of Hanover."—*Colonial Register.*

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* Ratio is the relative magnitude of two quantities. Thus the ratio of $\tfrac{6}{3} = 2$; that is, 6 contains 3 twice.

† A proportion is the equality of ratio. Thus the first term is to second as the third term is to the fourth, which is written thus—3 : 6 : : 4 : 8; that is, 6 contains 3 as many times as 8 does 4, or $\tfrac{6}{3} = \tfrac{8}{4}$. Again, the second term × into the third term = the first term × into the fourth term therefore—

$$\frac{\text{Second term} \times \text{third term}}{\text{first term.}} = \text{fourth term.}$$

* x always represents an unknown quantity.

THE ART OF THE SILVERSMITH.

By W. Herbert Singer.

(*Continued from page* 58.)

THAT era was not the time at which to expect great works to be created for religious use, especially by the country which gave birth to the Reformation, but at Augsburg and Nuremburg were manufactured every class of secular metal work in the greatest profusion. The artists of Nuremburg preserved in their work that German feeling of which I have spoken longer than their brethren of Augsburg, but in the latter part of the century, nearly all the silver work, especially that composed of figures and ornament in low relief, closely resembles that of Italy. In the form of their vases they still preserve their originality; and the arabesques with which these objects were often decorated are beautiful in design, and exquisite in workmanship.

In France, it was during the reign of Francis I. that this style reached the height of its power. The king, having seen the productions of Italian art, determined that his own countrymen should have the benefit and example of the greatest masters. Together with eminent painters and sculptors, Benvenuto Cellini was invited to the French Court, and by these artists was the cinquecento introduced and developed in France.

We have now reached a period in the history of the silversmith's art at which I desire to draw particular attention to England. Not that the work produced in this country during the fifteenth century is worthy to be classed before that of the other nations of Europe, but because the art of this land is naturally of the greatest interest to us; and, moreover, I do not think we should be satisfied with the state of this industry in England at the present moment; and if my humble efforts to-night are to lead to any practical result, it will be necessary to follow more closely the history of this art in our own country, and to devote but few words to the silver work of other nations.

It is sad to find that the records we have of silver plate in England during the sixteenth century relate more to destruction than creation. But for the wholesale spoliation which now befell the goods of the Church, what art treasures would have yet remained to us!

It is usual to credit Henry VIII. with having effected the whole of the ruin which now befell ecclesiastical property, but in the reign of his son, Edward VI., many of the parish churches retained their original plate. It was not, indeed, until the ultra Protestantism of Queen Elizabeth allowed all the churches to be sacked of the last remnants of these "monuments of superstition" that almost everything was swept away. Before this, however, a gradual devastation had been steadily going on, for in the last year of the reign of Edward VI., by order of the Commissioners, nearly all was seized but a few chalices, the number and size of those being left according to the size of the congregation. But even these could not long be spared, for directly after came injunctions from the king that all "monuments of feigned miracles" were to be ruthlessly extinguished. The chalice in which the mass had been celebrated came under this ban, and but few escaped its dire influence.

In the churchwardens' accounts for the year 1552, in very many parishes, will be found an entry relating to the exchange of the chalice and paten for a communion cup. But these new objects had but a short life, as upon the accession of Mary, in 1553, they were not, of course, considered fit for the restored ritual of the Church of Rome. The respite granted to religious art during the short reign of Queen Mary was, however, of no avail, as her half-sister, Elizabeth, was the most inveterate enemy to all Popish belongings.

(*To be continued.*)

NOTICE.

TO WATCH MANUFACTURERS.—A Manufacturer of Swiss Watches, of First and Ordinary grades, seeks a Manufacturer for whom he could make his watches; first-class references.—Address, Edouard Cattin fils, La Ferriers, Berne, Suisse.

A VACANCY for an Apprentice or Improver; exceptional opportunity for practical and theoretical tuition.—A.Z., Office of this JOURNAL.

CLOCK JOBBER, thoroughly acquainted with all the branches, wants Situation as Jobber or Examiner. Five years' References from an old London firm.—Apply by letter to S.Sp., 119, Falmouth Road, New Kent Road, London, S.E.

TURRET CLOCK MANUFACTORY for sale. About £3,000 capital required to take over the concern. The business, which is one of the oldest in London, can be conducted by a person having no technical experience. It should with economy in the working at once realise £1,000 a year net profit.—Full particulars and inspection of the books will be afforded to principals (or solicitors) only by Lepper and Blaxland, Solicitors, 72, Mark Lane, E C.

CORNER SHOP, Wigmore Street, W.—To LET, on lease, a shop, with or without the basement offices, a large room on the first floor, and three rooms on the second floor. These premises occupy a commanding position at the corner of Mandeville Place and Wigmore Street, with a superficial area of about 580 feet, and are admirably adapted for a first-class fancy business.—For further particulars apply to Holland and Sons, Furniture Makers, Decorators, and House Agents, 23, Mount Street, Grosvenor Square, London, W.

SHOW ROOM or GALLERY.—To LET, on lease, a large first-floor room, about 35 feet by 17 feet, well proportioned, and divided by columns into two parts; also the second floor of three rooms and servants' offices in the basement, with all necessary conveniences. Situate in a capital central business position, with good light. Private entrance. The ground floor could also be had if required.—For further particulars apply to Holland and Sons, Furniture Makers, Decorators, and House Agents, 23, Mount Street, Grosvenor Square, London, W.

FOR DISPOSAL, an elegant West End Retail Business (clocks, fancy leather goods, and jewellery); established and paying; incoming, including lease, fixtures, and stock, £2,000 to £3,000. — Particulars, personally, of Messrs. Barnes, Attree & Co., chartered accountants, 52, Gracechurch Street.

E. S., aged 20, is desirous of a Situation as Assistant in a jeweller's and watchmaker's; has been at the "Ecole d'Horlogerie," Geneva; present salary no object.—Address, 443, Fulham Road, S.W.

HENRY LAURANCE'S SPECTACLES.—Advertiser has about £50 or £60 worth of above; well assorted and in good condition. Not having time to attend to optical part of business, will sell the lot at *one half the net cost.*—Apply, by letter, Office of this JOURNAL.

WANTED, to purchase for cash, any Mechanical Novelty of *small size*, suitable for Watchmaker's window, such as Enlarged Movement Escapement, &c.—Send particulars to Office of this Paper.

THE WATCHMAKER JEWELLER AND SILVERSMITH'S TRADE JOURNAL.

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

Entered at Stationers' Hall.—Registered for Transmission Abroad.

CONTENTS.

	PAGE
Machine Work *versus* Hand Work (By James U. Poole)	71
Prizes for Art Workmanship	72
Machine Work *versus* Hand Work (A Reply to James U. Poole)	73
Taxation of Gold and Silver Plate	74
Depthing	75
Book Notice	75
Practical Instructions to Jewellers, Silversmiths and Electro-platers	76
To Make Chloride of Gold and Nitrate of Silver	77
Pebbles	77
The Construction of a Simple but Mechanically Perfect Watch	78
A Few Words on Gems and Precious Stones	79
Lectures on Watch and Clock Making	80
Queries and Answers	81
Repairing Swiss Watches	82
Novelties in Table Ware	82
The Crown Jewels of France	83
The Corundum Mines, Macon County, N.C.	84
Construction of Timekeepers Delivered to the Board of Longitude, March 7, 1805	85
Hall-Marking	86
The Art of the Silversmith	86
Patents	i
Monthly Record of Bankruptcies	ii
Directory	iv
Advertisements	i—xiv

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MACHINE WORK *versus* HAND WORK.

(*Continued from page* 60.)

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—In my previous papers I have described the elementary processes of the art of making a lever escapement, and the various methods by which learners had their latent powers developed. The old system of apprenticeship was, however, in many cases undoubtedly depressing in its influence, and the constant supervision of a vigilant practical master became so intolerable to some that they embraced the first opportunity of leaving their employment before they had properly learned the business, the consequence being that a number of half-trained workmen became scattered about the trade who, in the first instance, endeavoured to cut down prices, and frequently settled down to do one part alone. Thus, a frame escapement maker would have his pivoting and polishing done out of doors, by men who took no pride in the work, and who constantly resorted to stratagems to get through it, such as filing underneath cocks and potences, and not unfrequently lowering pillars to suit endshakes. The "escapement maker," in the meantime, manifested a sublime indifference to these performances, and supplemented them himself by making it a rule never to run a depth twice over or to replant a banking pin. If a shake was wide "the polisher took more off than he ought to have done, or *vice versa*, while the pallets would be unscrupulously tampered with to suit the depth. Add to all this that the bulk of common work was superintended by men who had little personal interest in it, and the causes of its decline in quality are sufficiently apparent.

I still keep to the illustration of the escapement, but precisely the same thing applies to the finishing department; owing to competition the prices gradually became reduced, so that it was practically impossible for a man to maintain himself without obtaining out-door assistance, such as I have described. Besides which, the majority of workmen for many years had a press of work beyond their own individual powers to get through, and were obliged to resort to all manner of expedients to satisfy the demands of employers. In many cases work was "farmed out," and faults were discovered by examiners, and by them passed over in order to complete their day's work, which were unknown to the manufacturer or the supposed finisher. It is not therefore surprising that the idea of making watches by machinery, and to a fixed plan, should have sprung into existence. The success of the large American watch companies arises from the fact that having embarked in business on a gigantic scale they are enabled to produce cheaply, and by the powerful assistance of machinery are better able to cope with the fluctuations of the labour market. The Waltham Company, whose position is fully assured, by coming directly to the front, have in a great measure made themselves independent of retailers, by which they are enabled to transact business on their own terms, and it is perfectly useless to attempt the manufacture of watches on a large scale in this country unless means are taken to acquire equal publicity. It is the consummate business ability and enterprise of our American cousins which has secured a position for their productions quite apart from their merits, which I am not now attempting to decry. But taking their watches all through, their competition ought not to be dangerous, either in price, quality, or performance, and as at the present time a very large proportion of the work is executed in this country, there is no reason why we could not manufacture on the same system. The attempt has, however, hitherto been beyond the reach of individual enterprise, and investors will not risk their capital in the production of goods for which the demand is doubtful. According to the evidence given by the representative of the Waltham Watch Company to the Select Parliamentary Committee on Hall-marking, 8th July, 1878, the great impetus was given to American watch companies twenty years ago, during the war, "when every soldier wanted a watch," so that there being a manifest demand to be supplied, capital was forthcoming, and machinery having been constructed, it was necessary to keep it employed. In making up watches in large quantities, it is of course absolutely necessary for them to have going barrels, in order to save the expense of employing a large number of skilled examiners to attend to the complications connected with the fuzee and chain, and the factory system is unavoidable. Men must be prepared to earn less, and to have their earnings supplemented by those of their wives and children. To do this openly is very repugnant to our Clerkenwell ideas, and subversive of much domestic comfort, but there would be no help for it, and it is being done at Birmingham. The skilled workmen who were trained on the old system, such as I have described, would be employed in the higher departments of the factory, for no machine can put a watch together, or spring and adjust it, and the most vigilant supervision requires to be exercised over the work, as a faulty pivot or a badly turned sink may be multiplied a hundred fold before the defect is discovered. It is this extra care which makes the best class of so called "machine made" watches so expensive. The great want in this country is a neat three-quarter plate lever watch at a low price, and this we have never been able to produce so as to command the market, and keep out foreign competition. An attempt was made to introduce something of the kind ten years ago, but the trade, including myself, were not then educated up to the proper point to regard the scheme with favour, consequently it fell through, and other attempts, on a more systematic scale, have not been financially successful in the past, whatever may be developing for the future.

For the best work, which is the back bone of the English trade, I believe in old-fashioned hand labour, and whenever possible the fuzee and chain, as I stated in my lecture at the Horological Institute in February last. It may not be out of place here to reproduce a paragraph from the explanations attached to the exhibits of my firm at the late Loan Exhibition of Scientific Instruments at South Kensington, showing how evenly balanced are the merits of the two systems when applied to keyless watches:—

"The fuzee principle in watches is the more scientific on account of greater accuracy of mainspring adjustment being attainable, but the keyless mechanism is more difficult to construct, as it is desirable that the winding wheels should be detached from the wheel on the fuzee axis during the going of the watch. The axis to a going barrel does not revolve, consequently the keyless wheels can always be in gear. Very satisfactory results can be obtained from watches with going barrels if regularly worn and wound, and complicated watches are generally constructed on this principle. The fuzee watch has the advantage of being able to have an index on the dial, to denote when it requires winding. This cannot be applied to going barrel watches of the ordinary construction."

The entire abandonment of the fuzee would abolish the distinctive feature of the genuine English hand-made watch, give increased scope to foreign competition and neutralise the efforts of the teachers of the classes at the Horological Institute and the Charterhouse School, for it is only the prospect of obtaining remunerative employment which induces young men to undergo a special course of training. It affords me pleasure to say here that I recently inspected the models of the various forms of the lever escapement constructed by Mr. Curzon, the teacher of escapement making at the first-named institution, and consider them admirably adapted for the purposes intended, and that the course of instruction is peculiarly suited to the wants of young men who have only imperfectly learnt their business. In bringing this subject to a close, I would say that although the heading of the article seems to imply otherwise, there need be no antagonism between the two systems of manufacturing watches, but to speak of a machine-made watch as distinct from being hand-made is in reality only a trade puff. Cheap English watches, by keeping their origin before purchasers, would assist to advertise those of a more expensive class, and thus both machine workers and hand workers would be mutually benefited.

I am, &c.,

James U. Poole.

PRIZES FOR ART WORKMANSHIP.

The Society of Arts offers medals in gold, silver, and bronze, and certificates of merit will be awarded for specimens of fine art applied to industry, exhibited in 1881, by manufacturers, designers, art-workmen, or possessors of such works. The works may consist of illustrations of any or all of the following processes, in combination or singly:—

1. Carving in marble, stone, or wood.
2. Repoussé work in any metal.
3. Hammered work in iron, brass, or copper.
4. Carving in ivory.
5. Chasing in bronze.
6. Etching and engraving on metal—Niello work.
7. Enamel painting on copper or gold.
8. Painting and modelling in pottery.
9. Decorative painting.
10. Inlays in wood (marquetry or buhl), ivory, or metal.
11. Cameo cutting.
12. Engraving on glass.
13. Wall mosaics.
14. Gem engraving.
15. Die-sinking.
16. Glass-blowing.
17. Bookbinding and leather work.
18. Embroidery.

To all works the name of the designer and art-workman must be affixed.

It is arranged with the council of the Royal Albert Hall, that the place of exhibition for the above-mentioned works will be at the Royal Albert Hall. The time for sending in the works will be published hereafter.

MACHINE WORK *versus* HAND WORK.

A Reply to Mr. James U. Poole.

No. I.

FROM Mr. Poole's statement (page 41) "that what is gained in rapidity of production is lost in beauty of finish, etc., etc.," I suppose he wishes us to understand there is no advantage in machine tools so far as watch-work is concerned. This is a startling statement. Nevertheless, if it be true that what is gained in one direction is lost in another, clearly there is no advantage. In order, therefore, to arrive at right views about one of the most important questions of our times—the machine tool question—it would be well to enquire, 1st, as to what is meant by *rapidity of production*, and, 2nd, *beauty of finish*.

1st. The advantage of machine tools is this: very large quantities of best work can be produced at a low price. In some instances a machine tool will turn out more work than twenty men. I will give a few examples, confining myself to watch-work.

Machine Work.	Hand Work.
(*a*.) Wheel blanks made by press tools can be produced at the rate of 30 per minute, or 14,400 per day. The quality of machine work always depends upon the quality and condition of the machine, and not on the skill of the operator. Whatever degree of perfection there is in the machine, it is transferred or imparted to the work produced by the machine. Assuming that the tool is as perfect as it can be made, the work will be of the highest possible order. I have sent a sample of this kind of press-tool work to the office of this journal. It is from Prescot, and though it is inferior to American work, it shows a great saving of labour to the system generally adopted there.	(*a*.) Wheel blanks made by hand tools with skilled hand work such as Mr. Poole describes occupy about one hour each, or at the rate of eight per day. The quality of the work depends upon the skill of the operator; the tools he uses may be of a second or third-rate character, and yet the work he produces may be of the highest possible order. In discussing this question it must be borne in mind that the patient production of a simple Hindoo will equal the work of a machine, but lacks rapidity of production. With machine tools you may accomplish in a few hours that which you would fail to do in a lifetime without them. A prophet once perplexed the world by saying a time will come when a "child shall die a hundred years old," and does it not seem a fulfilment when in the years of childhood we may accomplish what has been the work of a century.
(*b*.) The brass work of a going barrel can be made complete in a machine in three minutes, cr at the rate of 160 per day; that is to say, the barrel is turned inside and outside the main spring hook screwed in and turned down to a proper length, 90 teeth cut in the rim, the cover turned inside and outside and snapped into the barrel, and the chambers turned out for the stop work, and when put upon the arbor it will run as true and be as perfect as the machine that made it. The machine may be worked by a girl at wages 18s. per week; the cutters must be made and fixed by a skilled mechanic at wages £3 per week, but will not occupy one-fourth of his time. Cost of machine, £350, which will deteriorate at the rate of 10 per cent. per annum. Cost of barrel, 1¼d.	(*b*.) The brass work of a going barrel made in the turns on an arbor with drill bow and hand cutters will occupy a skilled workman two hours. This does not include cutting the teeth, for which a machine tool is used. Previous to the time of Dr. Hooke, who invented the dividing and cutting engine in 1655, even watch wheels were divided and cut by hand. During the past month I have examined a small square old English clock, in which all the wheels and pinions were divided and cut by hand, which must have caused a fearful expenditure of time. A splendid specimen of this kind of hand work can be seen in the Museum of Patents, South Kensington, a turret clock made in the year 1325, by Peter Lightfoot, a monk in Glastonbury Abbey. The clock is going.
(*c*.) A lever and pallets—about 30 per cent. of the work can be done in press tools, and the remainder by rotatory cutters in a milling machine in five minutes. I have deposited a sample of this kind of work at the Office of this Journal, where any interested reader may inspect it. They are made by Mr. Roberts, of 3, Gerrard Street, Islington.	(*c*.) A lever and pallets made by hand, equal in quality to the sample of machine work sent, will occupy a highly skilled workman about one hour. I have also deposited a sample of this class of work made by Mr. Tilling, of 11, Cloudsley Terrace, Liverpool Road, Islington, which occupied considerably over an hour. He (Mr. Tilling) said "It is very difficult to equal the work of the machine."

2nd. Beauty of finish. By this I suppose Mr. Poole means those graceful touches that are given to the work after it has been made in the grey, such as polished hollows, square shoulders, highly glossed faces to the leaves of the pinions, true surfaces highly polished, deep hollows, etc., etc. I frankly tell you I have no sympathy with those who ignore this kind of work, and tell us that a coat of black paint would do as well as the polish; but while I am charmed with beauty of finish, I cannot forget the fact that it is of secondary or minor importance. It is the mechanical principle and not the polish that makes the triumph of the watch.

Mr. Poole says "what is gained in rapidity of production is lost in beauty of finish." Now if you will examine the samples of work sent, you will find there is not one whit more finish in the hand-work described in the right hand column than there is in the machine-work described in the left. There is not a particle of truth in Mr. Poole's statement. It is childish to say it follows from the well-known axiom he has quoted. But why exclude the capacity of machine tools from giving the most exquisite beauty of finish? Is it not a fact that chronometer plates are finished in a machine tool, the spotting engine? I venture the contrary opinion that by machine tools you may gain not only in rapidity of production, but also beauty of finish. He thinks his views derive support from the statements of a "knight of the needle," a tailor or sewer of garments. "A recent conversation with a knight of the needle suggested some practical ideas on the subject. He said that machine work in his own handicraft, of equal quality to hand-work, was more expensive." When a scientific Clerkenwell watch manufacturer has to resort to such authorities for practical ideas in his business, it looks as if we were getting into low water. To show the advantage of a sewing machine would be out of place in pages devoted to watchmaking, and it is too late, seeing it is a necessity in a well regulated home. To say that this kind of machine-work of equal quality to hand work is more expensive, is to insult our common sense.

Mr. Poole next refers to the price lists of the American Watch Company—a document I would strongly recommend to the consideration of every watchmaker, whether he be master, journeyman, or apprentice. He says "it may be easily proved by referring to the price lists of the American Watch Company. The prices of best machine-made movements are considerably more expensive than our own." The statements that are made by manufacturers in their price lists cannot be regarded as a test of value. The only way to get at the relative value of American and English watches is to compare the work and prices of the two classes together—a comparison I think you will be slow to make. I have had considerable experience in repairing American as well as English and Geneva watches; and while I should be sorry to endorse everything that Americans have done, I am quite certain that some of the essentials of their work are far better executed and cheaper than our own.

The next piece of information Mr. Poole favours us with is "a watch with a fusee and chain could not be constructed by machinery, neither could a chronometer escapement." The word *construct* is sometimes used in the sense of devising, *arranging, inventing*; and if this is the meaning Mr. Poole attaches to the word, then I agree with him: for when intelligence or an active mind is required, machine tools utterly fail; but the word is also used in the sense of *to make*; and if this be his idea and the connection in which he uses it demands this interpretation, then I take issue, and unhesitatingly assert that a watch with a fusee and chain can be made by machinery, and so can a chronometer escapement. In proof of my statement I may remark that for more than 200 years a machine tool has been used to cut the threads of the fusee—the well-known fusee engine that was invented by Dr. Hooke. It is a fact worthy of notice that it contains the main ideas of the modern self-acting screw-cutting lathe which Maudsley, Clemments, Wilkinson, Whitworth and a host of others have so admirably developed. In every department of art we have had giants, but in none greater than in horology; and one of the most distinguishing features of English watchmaking of bygone days is the splendid tools that were devised and made, and which until recently were the envy and served as models to foreigners. To judge by the opposition now offered by English watchmakers to machine tools, a stranger might think we really did not know what good tools meant, whereas we have been by far the greatest inventors of successful machinery.

One of the most virulent opponents of machine tools that I know is Mr. David Glasgow; yet when he delivered two lectures before the British Horological Institute, on the isochronism of the pendulum spring, occupied a considerable portion of each of these lectures with instructions for making a tool for coiling up the spring, and he is careful to give the minutest details and diagrams to make the tool correctly. Now if superiority existed in hand work, why this tool? Thirty years ago I was instructed to coil up a spring by hand, and taught to believe they were better than those made in a tool—a fallacy that is entirely exploded.

Now if the work of the tool is best calculated to grapple with the subtleties of isochronism, I should like to know what there is in a fuzee watch with a chain, or in a chronometer escapement that cannot be constructed (made) by machinery.

A few years ago, when American watches were placed on this market, a considerable amount of feeling was shown against machine work. With the desire to disseminate the truth, the whole truth, and nothing but the truth, I called upon the chief speaker, and expostulated with him respecting what he had said, and to convince him of his error showed him several pieces of machine work, such as wheel blanks, cutting pivots, keyless work, studs, etc., and after expressing approval at what I had shown, he concluded, —"If I had seen this before, I would not have said what I have said." If it be "folly and shame to answer a matter before you hear it," what shall be said of those who condemn work they have not examined. Mr. Poole ventures this unwise statement because he does not know the capacity of machine tools.

About this time a polite invitation was sent by the Elgin Watch Company, whose officials were then on Holborn Viaduct, to these gentlemen to go to their offices and examine their machine work, a compliment we are not able to return. Three of the leading experts in Clerkenwell attended at their offices. One of them is one of our largest and best chronometer makers, and is one of the most advanced mechanics in the English watch trade, whose time is occupied in springing and timing. After he had examined several specimens of second and third rate work, and expressed his approval of them, he asked this question, and it is to this question that I wish to direct your special attention.—"What will you charge to make me marine chronometer staffs equal in quality to these?" Now if one of the best chronometer makers in London desires nothing better than machine made staffs for chronometers I think it is not too much to say that a chronometer escapement can be made by machinery. The information above given I have from the gentleman to whom this humiliating question was put. Richard Whittaker.

(*To be continued.*)

Taxation of Gold and Silver Plate.—The duties upon gold and silver plate in the year ending March 31, 1880, produced—Excise, £63,784; Customs, £5,294; Licenses to deal in gold and silver plate, £43,073; total, £112,151. Comparing these figures with the corresponding period to March 31, 1879, a great decrease is observable, the amounts being—Excise, £82,767; Customs, £5,853; and Licenses, £43,071; Total, £131,691. Decrease, £19,540.

TAXATION OF GOLD AND SILVER PLATE.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—By the time when your next number has been issued we shall have entered upon what it may be hoped will prove to be an eventful year for British goldsmiths and silversmiths. The duties upon gold and silver plate are not unlikely to be abolished. Of course, as yet, no indication has escaped Her Majesty's Government as respects their immediate fiscal policy; but rumours are abroad, and if, as has been rumoured, the Goldsmiths' Company intend to take the initiative, and to press for the abolition of the duties, success will, in all probability, attend their efforts. The appeal to the Chancellor of the Exchequer would be unanswerable. In the first place, the fact is before us that no similar handicraft is subject to taxation; secondly, the particular handicraft, silver plate, has, as it has often been urged, to compete with electro-plate, which is not only untaxed, but is permitted to assume marks so closely resembling the Hall-mark as to be scarcely recognisable at arm's length; thirdly, the duties have been condemned all but unanimously by a Select Committee of the House of Commons. This latter point is one of great importance, and it might be expected to weigh with Mr. Gladstone. A duty once condemned is most damaging to an industry, inasmuch as manufacturers and dealers no longer feel any security in investing money in duty-paid stock. There arises an indisposition to work upon stock, or to replace articles sold. The workpeople are not able to make full time, and all attempts at improvements cease as a matter of course. Everyone connected with the silver trade knows that such has been the effect of the report of the Select Committee issued in 1879. The trade has been going back to an extent quite alarming—over 100,000 ounces per annum. This retrograde tendency will not stop until the duty has been abolished; in my opinion, it will still further develop itself as the public become educated to a belief that the tax is doomed.

Again, it is not to be expected that the agitation will cease; I can answer for that; it shall not cease. Every day that the agitation is prolonged, the worse for the trade. All this can be submitted to Mr. Gladstone. Another point could be urged, viz., that the amount of the tax is such a bagatelle. In the year ended March 31st, 1880, it produced only £69,078, as against £88,620 in the year 1879, and £84,773 in 1878. Roughly, the estimate for 1881-2 would not exceed £60,000.

Then comes the question of a drawback upon existing stocks. That is a question of extreme importance, and it behoves the trade at once to look into it; "Union is strength," therefore let us unite. Parliament meets on the 6th of January, the day upon which this letter will be published. There is not a day to lose. The budget will be arranged very shortly afterwards, not later than the beginning of March, for presentation in April, before Easter.

The Goldsmiths' Company would do well to call the trade together at once, and to undertake the necessary expenses of consulting country manufacturers and dealers, so far as their names and addresses can be ascertained. In the hands of an energetic honorary secretary statistics could doubtless be obtained as to the probable amount of existing duty-paid stocks, from which a scheme could be decided upon for presentation to the Chancellor. If the Goldsmiths' Company act promptly, they will be entitled to the thanks of the trade.

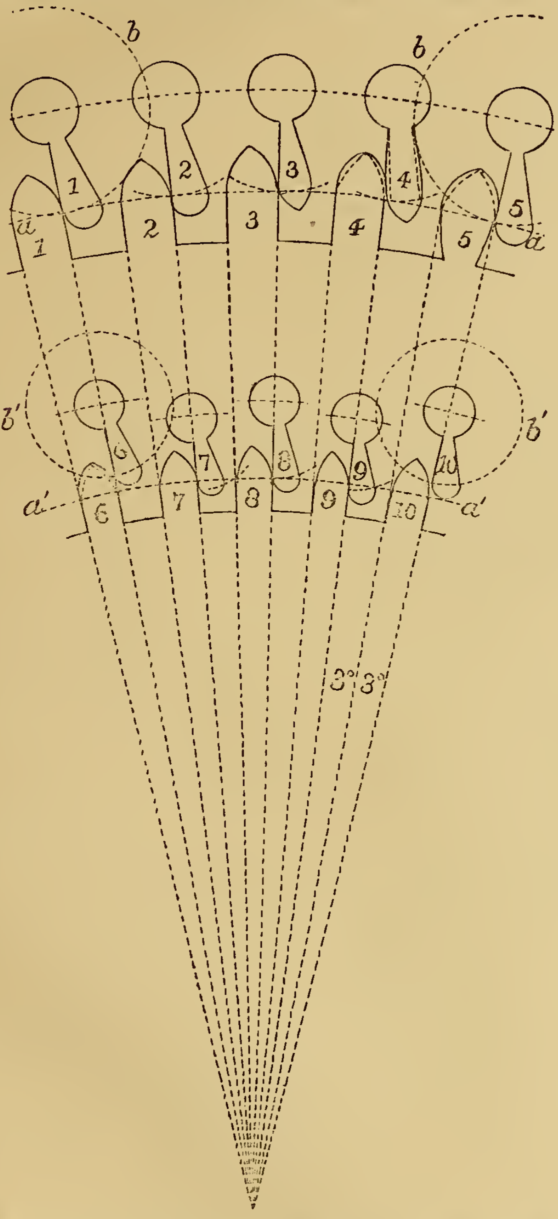
I have the honour to be, Sir,
Your obedient servant,
Edward J. Watherston.

Pall Mall East,
December 28th.

DEPTHING.

THE subject of depths, or wheel and pinion gearing, has seldom been so clearly and simply explained as in the following diagram and translation from the *Allgemeines Journal der Uhrmacherkunst;* being an abstract from the articles on depths in Alb. Johann's *Lehrbuch der Uhrmacherkunst,* and is worth preserving in connection with watch repairing. The proportional sizes of the drawing are made quite correct.

a 60-tooth wheel gears with a pinion of 6, the radius of the primitive wheel circle (pitch circle); *a a* is to the primitive pinion circle exactly as 10 to 1, and the depth could therefore be made correct if the roundings of teeth and pinion leaves were made correct in principle; this is in order to compare with faulty depths. Shown on a large scale by tooth 1, and pinion leaf 1, because the deepest point of the epicycloidal curve of the tooth (that is where the straight lines at its side verge into a curve) begins its pressure on the pinion leaf at the outermost point of its straight surface. Such a depth works without loss of force, and therefore answers well.



Let us now look at tooth 2 and leaf 2; here we find that on the correctly formed pinion leaf a tooth works, which has its curve formed too low, because the outermost point of the straight inner surface of the wheel tooth does not reach up to the corresponding outermost point of pinion leaf; in this case a little force is lost, because the curve of the wheel tooth butts a little against the curve of the pinion leaf; besides this, the point of tooth in moving on does not allow the leaf to come 60 degrees forward, because of the tooth with its too deep curve not being able to make its corresponding 6 degrees. In No. 3, 3, the wheel tooth is correct, but the curve of pinion leaf is too sharply rounded, whereby, so to say, the same result obtains as was the case in 2, 2, only with this difference, that in 3, 3 the fault was in the pinion leaf, whereas in 2, 2, the wheel tooth is at fault.

In 4, 4, both parts are incorrectly formed, because the tooth is too round, and the leaf has no straight surface, but instead of that is also slightly curved. Such a depth causes unnecessary friction and some loss of force, but it can be improved if the tooth is curved with the Ingold fraise or cutter to the dotted lines, and the pinion leaf is made flat on its side; the last is, however, a more troublesome job than the making of a new pinion would be. 5, 5, shows a depth such as is often met with in otherwise well executed watches, and which have perhaps already, during 40 or 50 years, given satisfactory service, still it is a fault which I would advise to correct. Round up the wheel with an Ingold fraise, but do not make it smaller, and a better and more powerful depth will be obtained, and the pinion will wear no more. The depths hitherto enumerated were all planted properly, that is, the pitch circles touch each other but do not intersect. In 6, 6 this is however not the case, the pitch circle of pinion does not yet reach the wheel circle, here we have, therefore, to do with a shallow depth; probably the depth has been pitched too shallow in order to favour the circular form of the top of wheel tooth, because its side surface continues too far out. This depth is however easily corrected by curving the teeth with the Ingold cutter, adjusting it in depthing tool, and replanting. 7, 7 is fixed too deep, as the pitch circles intersect each other, but further the wheel tooth has the fault, that its curves are cut too far in, which no doubt has been done by rounding up with the ordinary rounding up cutter, but of incorrect form and widths. In consequence of this incorrect curve one has been obliged to plant the depths too deep. It can be somewhat improved by making the side surface longer (with a thicker cutter), and then pitching the depths shallower. 8, 8 shows a good and correct depth. 9, 9 is only too deep and will be proper when pitched shallower, because tooth and leaf curves are correct in principle. 10, 10 will also be correct and good if pitched as deep as the pitch circles. One wheel tooth and one space contains each 3 degrees of circle, as shown in the drawing.

BOOK NOTICE.

Praktische Abhandlung über die Repassage einer viersteinigen Cylinderuhr. By HERMANN HORRMANN. Leipzig, 1881. Hermann Schlag.

IN 1879, Mr. H. Schlag, publisher of the *Allgem. Journal der Uhrmacherkunst,* offered a prize of 100 marks with handsome diplomas for the best essay on the examining of a cylinder watch with four jewels, and it appears that no less than forty papers were sent in, all of them giving signs of great ability and industry, a fact which speaks well for German watchmakers. It was no easy task for the jurors to award the first prize among so many excellent essays, but after the carefullest consideration it fell to the lot of Mr. Hermann Horrmann, a watchmaker in Gnoyen (Mecklenburg-Schwerin), and the treatise announced here is a reprint of the successful essay published by the excellent journal above alluded to. Every watchmaker who is master of the German language should obtain a copy.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. XXI.

(Continued from page 61.)

Cold Electro-gilding Baths.—The proportion and nature of the salts employed varies almost infinitely, but we shall only give the three formulæ most frequently used, with good results:—

I.—Distilled water, 2⅕ gallons.
Cyanide of potassium, ordinary 70 per cent., 10½ ounces.
Pure gold, 3½ ounces.
Aqua ammonia, 17½ ounces.

Heat the gold in a glass flask with 9 ounces of pure hydrochloric acid, and 4½ ounces of pure nitric acid. When the gold is dissolved, continue the heat in order to expel the acid fumes, and until the colour of the liquid is dark red, nearly black. Remove from the fire, and dissolve the crystalline mass formed in cooling in three or four pints of water, and pour into a large porcelain dish. Add the ammonia, which produces an abundant yellow precipitate of gold ammonium, pour upon filtering paper, and the filtered liquid, which still contains traces of gold, is kept with the saved waste. Wash the precipitate remaining upon the filter several times with cold water, until it no longer smells of ammonia. It must not be dried, as it is a fulminating mixture, and consequently very dangerous. Next dissolve in the vessel used as a bath the cyanide of potassium in the distilled water. Filter, and add the wet gold ammonium, which rapidly dissolves when stirred, and forms a clear gold bath. But before using it cold, the ammonia should be expelled by boiling for about one hour. For a newly prepared cold electro-gilding bath the ordinary cyanide of potassium is preferable, on account of the potash it contains, which renders the liquor a better conductor of electricity. But for the preservation of the strength the pure cyanide is better, as it possesses the advantage of a constant composition, and does not load the solution with foreign salts. The gold solution for maintaining the metallic strength of the bath is prepared as follows:—

Transform the gold into precipitate of gold ammonium, as above described, place it in water, 2 pints of water to 4 ounces of gold, then add cyanide of potassium until the liquor is colourless. If there is not sufficient water with the gold ammonium, the liquor will be dark red, and will not be decolourised by cyanide.

II.—Distilled water, 2⅕ gallons.
Cyanide of potassium, pure, 7 ounces; or
Ordinary cyanide according to strength, 10 to 14 ounces.
Pure gold 3½ ounces.

Make a neutral chloride of gold, as in the preceding formula, and when cold and crystallized, dissolve it in 3½ pints of water, filter if needed, dissolve the cyanide in 14 pints of water, filter, and mix the two solutions, which become colourless. When it is possible to boil this bath for half an hour before using it, it becomes a better conductor of electricity, and the gilding is more uniform. Its strength is maintained by additions of neutral chloride of gold and pure cyanide of potassium, from 1 to 1½ of pure cyanide to 1 of gold. Both the above baths may be diluted with once or twice their volume of water, the gilding will remain fine, but the proportion of gold deposited will be less in a given length of time.

III.—Yellow prussiate of potash, 7 ounces.
Pure carbonate of potash, 5 ounces.
Sal ammoniac 1 ounce.
Pure gold, transformed into chloride, ½ ounce.
Water, 2⅕ gallons.

Boil all the salts together, less the chloride of gold, separate by filtration the precipitate of carbonate of iron, then add the chloride of gold dissolved in a little water, and allow the bath to cool off. Any kind of gold salt, and the oxide, or even finely powered metal, may take the place of the chloride of gold; but the latter is prefered on account of the facility of its preparation, and of its solubility. Any kind of gold salt will be transformed into cyanide by the cyanide of potassium. The small proportion of the chloride of potassium resulting from the transformation of the chloride of gold into cyanide does not prevent the good working of the baths. The addition of a little prussic acid produces a brighter but thinner gilding. The indicated cyanides may be replaced by the cyanides of sodium, calcium, and ammonium. Cold gilding baths are generally kept in porcelain or stoneware vessels; but for large volumes of liquor use wooden troughs lined with gutta-percha plates. The sides of the troughs support anodes of laminated gold, which dip entirely into the liquor, and are held by small platinum wires they are connected with the positive pole of the battery. Suspend the articles by means of metallic slinging wires to a movable frame of clean brass rods connected with the negative pole. The deposit of gold should be pure yellow, but it has sometimes a dull earthy grey colour. In that case scratch-brush it with the greatest care, and then pass it through the ormolu colouring. The gold anode conducts the electricity, and also maintains the metallic strength of the bath up to a certain point; but it is necessary to add now and then either the oxide or the chloride of gold, and a certain proportion of cyanide of potassium to make up for that transformed into carbonate of potash and cyanide of ammonia. The proportion of cyanide is about double that of the chloride of gold added. This is ascertained by the colour of the bath and the shade of the deposit; if the proportion of the chloride of gold is too great, add more cyanide; if gold predominates the deposit is quite black or dark red; when the cyanide is in excess, the gilding is very slow and grey, and it will sometimes happen that pieces already gilt will lose their gold. When the bath is not in use the gold anode must be removed from it, otherwise it will be dissolved. If the anode were partly immersed in the bath, it would be rapidly cut at the level of the liquid. For this reason use the platinum wires, which are not acted upon. It is remarkable that the solutions of cyanides, even without the action of the electric current, rapidly dissolve all the metals except platinum in the cold or at a moderate temperature, and that at the boiling point they have scarcely any action upon the metals. Cold electro-gilding should be done slowly, and it is necessary to often look at the pieces in the bath, and scratch-brush those with an irregular deposit, or with dark spots. The intensity of the current should be often changed by increasing or diminishing the number of the elements, or the strength or the volume of the liquors in the battery. With too much intensity in the current the deposit is black or red; it is yellow with the proper amount of electricity. With a weak current those portions opposite the anode only get covered with gold; it is well to change the position of the objects often, in order that the deposit be regular. With a freshly prepared bath, it may happen that surfaces already gilt will lose their gold by changing their positions. This is a sign that the bath contains too much cyanide of potassium and too little gold, or that the electric current is too weak.

(To be continued.)

TO MAKE CHLORIDE OF GOLD AND NITRATE OF SILVER.

(From the *Deutsche Chemiker Zeitung*, by H. Bush, Hull.)

PROCURE 8 grams=5 dwts. of fine gold, and after rolling out to thin plate, cut into small strips. Get an olive oil flask, and clean it well with a warm and saturated solution of soda and water. Fill the flask half full of water and set on a sand-bath over a heat that will slowly bring the water to boiling, which will both temper and test the flask; if it stands this test it is fit to be used. Put the pieces of gold into the flask, then mix in a small bottle half an ounce of pure nitric and two ounces of muriatic acid, and pour some of this into the flask to cover the pieces of gold, place it in a sand-bath over a gentle heat and put over the mouth of the flask a small piece of glass to prevent the solution from spirting out whilst in action. As soon as the acid ceases to act on the gold, and if any remains undissolved, add more of the mixed acid and continue to add little at the time as often as it stops acting on the gold until all is dissolved; remove then the flask from the sand-bath and let it cool, then add to it about its like quantity of water, and boil over a heated sand-bath until about half of it is evaporated; remove and pour the solution into a glass or porcelain dish, and rinse the flask several times with small quantities of warm water which add to the solution.

Now prepare a filter in a small glass funnel, place it in the flask and filter the solution back, and before the filtering is nearly completed pour a few drops of water at a time into the filter in order to wash the gold out of it, and until the solution is increased to about a third in bulk, then return it to the sand-bath and evaporate again to about half; after this pour the solution into an evaporating dish and rinse the flask with warm water and add the rinsing to the contents in the evaporating dish, then add about 1 gr. 50 centigr. of fine table salt for each gram or 1½ dwt. for each dwt. of gold dissolved; place it on the sand-bath, stir it well with a glass rod until perfectly dry, then allow it to cool, when it will be ready for use or to be poured into small bottles for sale. The 8 gram or 5 dwt. of gold used will realize 24 bottles containing 1 gram or 15 grains of chloride of gold to each bottle, and will pay well for the trouble of preparation. The chloride of gold prepared in this manner will answer for making solutions for electro-gilding or for photographic purposes.

To make nitrate of silver, take granulated fine silver and put into a glass flask similar as used for dissolving gold, pour pure nitric acid mixed with about half the quantity of warm water into the flask to cover well the silver, place the flask in a sand-bath over a gentle heat or into a vessel of hot water, which must be kept hot by placing over a spirit lamp until the acid ceases acting on the silver; if silver remains undissolved in the flask, remove it from the sand and let it cool; then pour off the liquid into a porcelain dish, add a little more acid to the remaining silver in the flask and place it again over heat until dissolution of silver ceases, and keep on repeating the decanting and adding until all the silver is dissolved. By this method an excess of acid is avoided. After the solution has cooled add to it about half its quantity of water and filter it through asbestos broken up and placed in the filter in the neck of the funnel; after filtering pour into an evaporating dish and place it on a heated sand-bath and evaporate until you perceive a light scum on the surface of the liquid, when it is removed and allowed to cool, and when nearly cold is placed on ice covered over and left undisturbed for twenty-four hours, when crystals of nitrate of silver will form; the crystals are removed with a pair of platinum pincers into a glass funnel placed into the neck of a bottle, and as soon as the crystals have given over dripping pour quickly about an ounce of water over the crystals, and after done dripping repeat it twice more, take the crystals out of the funnel and spread them out on a china plate and place on a warm stove to dry. Pour then the washings of the crystals back to the remaining silver solution not yet crystallised, evaporate and filter the same as before and set by to crystallise, and repeat the process until nearly all the silver is disposed of. The small remainder of silver solution may be decomposed into chloride of silver by adding gradually small quantities of salt water.

In order to obtain crystals of large size, the moment of forming the scum on the solution has to be watched during evaporation and advantage taken of by removing it from the sand-bath at this point. Another advantage of greatly accelerating the formation of crystals is to put a piece of nitrate of silver into the solution before placing it on the ice. This method will produce nitrate of silver of a better and purer quality than generally bought of dealers.

PEBBLES.

THE old but ever true saying, "The best is the cheapest," is nowhere more applicable than in the case of pebbles. These indispensable articles were invented with a view of rectifying or improving defective sight, and if of good quality and judiciously chosen, certainly fulfil that purpose; but, on the other hand, a faulty pebble, however slight the defect may be, will prove unsatisfactory and injurious to the wearer. Nothing is more common in the experience of a shopkeeper, unless he deals only with manufacturers of reliable goods, than to have customers bringing back glasses which have failed to answer, some fault or other not noticed when selecting showed itself when the pebbles were quietly and seriously tested at home. The trade is of course well aware that quantities of such pebbles, called "wasters" by the manufacturers, are in the market, and many are tempted to buy them on account of the low prices. We think that no shopkeeper will find it profitable in the end to keep this class of goods; nor should manufacturers who have a reputation to lose allow faulty pebbles to leave their premises. What has secured such a reputation for "Laurance's spectacles"? Nothing but the strict determination on the part of that manufacturer to sell nothing but sound pebbles, which can be relied upon, and therefore prove equally satisfactory to the shopkeeper and the public. The largest manufacturers of pebbles in this country are Messrs. S. J. Lazarus & Co., of 120 and 121, Newgate Street, London, E.C., an old-established and well-known firm. We had recently an opportunity of examining the extensive stock of this house, and we are glad to be able to say that it does not contain any of the "wasters" above alluded to, nor do they allow any defective productions of theirs to get into the market. At the same time their prices are very low, and we think the trade, shippers, and other large buyers would do well to pay a visit or apply to this firm before re-stocking for next year. We may add that Messrs. Lazarus & Co. are the sole manufacturers of the pantoscopic tinted lens spectacles for weak and defective sight, and that they are also importers of every kind of optical goods.

A novel piece of jewellery is now being exhibited in Paris. It is no other than a huge spider in diamonds, the abdomen of the insect being formed of one large yellow diamond of an oval form, while the legs and fangs are composed of small diamonds. It is indeed said that spiders in gold, silver and precious stones are to take the place of the jewelled pigs for which there has been such a passion of late, the spider being equally emblematic of good luck as well as being more uncommon.—*Pawnbroker's Gazette.*

THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.*

By M. GROSSMANN, Watch Manufacturer, Glashuette (Saxony).

(*Continued from page* 67.)

61. There remains a word to say on an improvement of recent date. It has already been mentioned (54) that the centre pinion and the barrel are in constant danger of having their teeth bent or broken by the sudden jerk of a breaking main-spring. These accidents are so troublesome that a number of little contrivances have been made in order to avoid them. It will not be useless to give a look and a thought to these inventions, and to consider whether they are really what they ought to be.

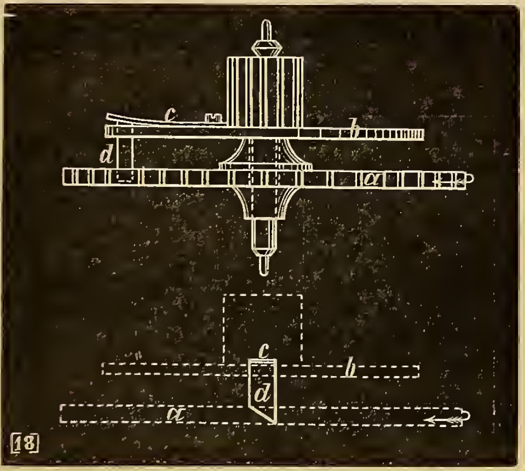
For watches of a diameter of 43 m. or more, a train with pinions of 12 is highly recommendable, but only under the supposition that the utmost care can be bestowed on the correct pitching, and rectifying of the depths. The followiug would be a suitable arrangement for a train of that kind:—

Barrel ...	105 teeth.	Centre pinion	...	14
Centre wheel	96 ,,	,,	...	12
Third wheel	90 ,,	,,	...	12
Fourth wheel	80 ,,	,,	...	8
Escape wheel	15 ,,			

The resulting sizes of teeth are—

Barrel	0· 30 m.
Centre wheel	0· 24 m.
Third wheel	0· 22 m.
Fourth wheel	0·216 m.

62. There is one of these precautions consisting of a kind of elastic transmission on the third wheel. This wheel (Figs. 20 and 21) is fitted with a collet, loose on the pinion, which carries a disc, *b*, riveted to it. On this disc is fastened a spring, *c*, with a perpendicular arm, *d*, which extends towards the third wheel, and reaches the arms of this wheel with its aid, thus carrying the wheel with it while the watch is going. The end of the arm has a slight slope, and when the spring breaks it is expected to slip over the arm of the wheel by the violence of the shock, and thus to top it. I should not advise the use of this safety apparatus, because I think it will fail by the inertiæ of the parts between the third wheel and the mainspring. The destruction, by a sudden jerk, will be completed before its power reaches the third wheel, in a like manner as the blast powder in a hole made in solid rock, and stopped up with a little clay, will split the rock by its sudden action before it has time to drive out the small stopping. Besides, this arrangement, if it should have any chance of success, must have the spring exactly regulated, so that it does not yield to the pressure of the mainspring when fully wound, but that any pressure beyond this will make it slip over. If this be not the case, the safety of the centre pinion will not be attained; and, if it be, any excess of pressure, by inconsiderate winding at the end of the operation, will make the spring run over, and the result of this would be a deviation of rate. Now, I think the wearer of a watch will find an irregularity of its performance a fault of a much more grave character than an occasional accident which he knows to be out of connection with the time-keeping of the watch.



FIGS. 20 & 21.

63. Other contrivances promise better success, because the regulating resistance is in the centre pinion. This latter has a rather large hole, and is adjusted on a staff or axis, to which the wheel is riveted, the pinion being held fast on the staff by a screw nut and a washer. This pinion, if it is set in motion, performs like a solid one, owing to the frictional resistance which keeps it to its staff being a little in excess of the strain effected on it by the moving power; but any addition to this strain causes the pinion to move independently of its staff, and thus to counteract the strain without injury to any of the acting parts. It will be readily understood that this disposition protects the centre pinion and barrel teeth not only against the sudden shocks of a breaking spring, but also against any unequal strain in winding, and all this without any alteration of the time shown by the watch.

However, this contrivance has also its weak side. The centre pinion, with its large hole, especially when it is of a lower number than 12, has too little stock left between this hole and the bottom of the teeth, and thereby the solidity is endangered from another side. Therefore, it will answer in the case of a watch the hands of which are set at the front, but it will hardly do for the hollow centre pinions used for setting the hands on the back.

64. Some years ago I had in hand a similar safety centre pinion of English make, also with a staff on which the pinion was screwed with a three-headed screw. Tapped into the hole of the pinion, and cut on the staff, this screw—which must be a right-handed one if the centre wheel is above the pinion, and a left-handed one if it is below the pinion—is kept tight in the ordinary course by the pressure of the motive power. But when a backward shock is applied to the pinion, it unscrews, thus obviating any injurious effects. This, though it appears very effective, is still open to several serious objections. The additional strain at the end of the winding operation is not counteracted, but tends to screw the pinion still closer, so that it is doubtful whether in case of emergency it would break or unscrew, especially considering that the pinion itself, by the large dimensions of its hole, is rendered rather frail. Besides this, there is no saying from which side the shock of the breaking spring will come. If the spring breaks near its outer end, the shock will apply in the way of the regular tension of the spring, and the safety apparatus will be of not the slightest use; on the contrary, the pinion weakened by the large hole will stand a poor chance. It will only be effective in case of the spring breaking near its inner end.

65. There is a general demand for anything effecting a guard against accident to the centre pinion, and every thinking manufacturer ought to make this an object of his reflections. Still, it seems the right thing is not found yet.

The best contrivance is certainly that of adjusting the pinion on a round and slightly taper staff, and to hold it fast by a screw nut and washer; but it has the objection of diminished solidity of the pinion itself against it.

(*To be continued.*)

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A FEW WORDS ON GEMS AND PRECIOUS STONES.

By Edward J. Watherston, F.S.S.

(*Continued from page* 42.)

NEXT the stone found its way into the hands of an Indian diamond merchant, Jamchunch, who in turn sold it to Major Pitt, Governor of Fort St. George, for the sum of £12,500. Governor Pitt, well aware that his gem was worth twenty times the amount he had given for it, brought it to Europe with him, but its possession made him so unhappy, that he could neither eat, drink, nor sleep. He was in constant fear of being murdered, and scarcely dared to venture out of a room in which he had barricaded himself. Herr Uffenbach, a scientific German gentleman who visited London in 1712, gives a most amusing account of his attempts to see Governor Pitt's diamond, but found all his endeavours unavailing. The miserable possessor of the precious gem was so frightened that he would not either show himself or his treasure to anybody, trembling even when in his rare promenades away from home some passer-by looked steadily at him. To get rid of his Frankenstein he offered it many times for sale, and at last found a purchaser in the Duke of Orleans, Regent of France, who bought it for £135,000. Henceforth the "Pitt" became the "Regent." The price paid by the Duke of Orleans for the stone was held to be very small, for a commission of the most expert jewellers in France, called together to value the "Regent" soon after its purchase, appraised it at £480,000. At the death of the Duke of Orleans, the "Regent" was placed among the crown jewels of France, from which it mysteriously disappeared in 1792, during the anarchy of that period, but was recovered soon after. The "Regent" then went to ornament the sword of Napoleon Bonaparte, and by him was pledged to some Amsterdam Jew for a large sum of money, the possession of which enabled the "First Consul" to accomplish the revolution known as that of the "Eighteenth Brumaire," a stepping-stone to the imperial throne of France. A little gem, not larger than a pigeon's egg, thus played an important part in shaping the history of Europe.

The diamonds next in size to the "Regent," generally held to be "the most perfect brilliant in existence," are the "Orloff," and the "Star of the South." The "Orloff," weighing 193 carats, cut as a "rose," is reported to have formed once the one eye of an Indian idol, the far-famed goddess of Sheringham. A French soldier "looted" it, and sold the stone for a trifle, after which, by many wanderings, it found its way into the hands of Prince "Orloff" and the Imperial Russian Treasury, the Empress Catherine II. purchasing it for £100,000, with a perpetual annuity of £4,000. At present the "Orloff" is set at the top of the Czar's sceptre, forming its most distinguished ornament, but only exhibited on high occasions. Nearly of the same size and shape as the "Orloff" is the "Star of the South," found in Brazil, in the mines of Bogagen, by a poor negress, in July, 1853. It originally weighed 254 carats, but was reduced, by being cut as a "brilliant," to 124 carats, or less than half its size. Considering the enormous price set upon diamonds of the largest size, it is strange to find that several of them should have been deliberately cut down to much smaller dimensions, simply to give them an artificial shape, little increasing their original beauty, but immensely decreasing their value. It is estimated that the Russian "Orloff" lost four-fifths of its value by being cut down to one-half its original size.

The most striking instance of such injudicious cutting is to be found in our own famous "Koh-i-noor." As beforementioned, this stone, once going by the name of the "Great Mogul," was originally of the weight of 787 carats, but "polished down" by an unhappy and unskilful Venetian lapidary to 280 carats, and as such came into the possession of the crown of England. It was then a "rose," but Prince Albert, not liking the appearance of the crystal flower, conceived the idea of having it re-cut. After consulting Sir David Brewster and other scientific men, it was determined by the Prince Consort, with the consent, of course, of the Government, to polish the "Mountain of Light." For this purpose, one of the largest of Dutch diamond merchants, Mynheer Cöster, of Amsterdam, was engaged, and he sent over to London his most experienced artisan, one Herr Voorsanger, with assistants, to "improve" the "Koh-i-noor." The improvement was carried on with the help of a four-horse power steam-engine, which began working on the 6th of July, 1862, the Duke of Wellington placing with his own hands the "Mountain of Light" on the cutting machine. For thirty-eight days the unlucky diamond was swung round on it, until it had been reduced from 280 to 102 carats, at a cost to the Government, or rather the nation, of £8,000. It was, as truly remarked by Mr. C. W. King, one of the best writers on and judges of gems in this country, "a most ill-advised proceeding, which deprived the stone of all its historical and mineralogical value," reducing the once famous stone, "unrivalled in Europe," to "a bad-shaped shallow brilliant of but inferior water." *Sic transit gloria mundi*, even for such "everlasting" things as diamonds.

The "Mountain of Light," reduced, alas, to a mere mole hill by the energy of Mynheer Cöster's steam engine, closes the list of remarkable diamonds known to exist at present. There are several others frequently mentioned, such as the "Shah," the "Nassack," and others, but they are either of no great size, being under 100 carats, or with no historical interest attached to them.

The historical interest is still more wanting in regard to other precious stones of all sorts handed down to the present time. Of rubies scarcely more than two deserve being mentioned as such. The first and most famous of existing rubies forms part of the Imperial state crown made for Queen Victoria in 1838, embellished with all the gems left after the destruction of the regalia during the period of the Commonwealth, and subsequently added to by purchases. This ruby, standing in the centre of the Maltese cross, on the top of the British crown, and the most conspicuous gem on it, is believed to be, on tolerably good authority, the same as that worn in front of the helmet of King Henry the Fifth at the battle of Agincourt. Unlike famous diamonds, rubies have no proper names, but this one in the British crown might well be called the "Agincourt." Its history can be traced to the year 1367, when, after the battle of Nagara, near Vittoria, King Pedro of Castillo presented it to Edward, the "Black Prince." The "Agincourt," if so it can be called, has a small hole bored through it, after a fashion common in the East, to be hung by itself round the neck. This hole is now filled in the front part by a small ruby, to be distinguished only from the stone by close examination. Of about the same size as this ruby is another, formerly among the regalia of Austria, but of the present existence of which, little, if anything, is known. The Emperor, Rudolf II., received it in 1360 from his sister, Queen Dowager of France, it being valued at the time at 60,000 ducats, or about £30,000. It would now probably be worth not far from half a million sterling, the value of the ruby having increased in modern times more than that of any other precious stone.

Of the general value of gems at the present moment it is very difficult to say anything, the market price being dependent from a great variety of conditions, chief among them not only size, but form, colour, and purity. Of course, King Fashion has a very great deal to say to this—as to many other things.

(*To be continued.*)

LECTURES ON WATCH AND CLOCK MAKING,

PREPARATORY FOR THE ELEMENTARY EXAMINATION OF THE CITY AND GUILDS OF LONDON INSTITUTE IN MAY, 1881.

DELIVERED AT ST. THOMAS CHARTERHOUSE SCHOOL BY I. HERRMANN, ON MONDAY EVENINGS FROM OCTOBER 25TH.*

(*Continued from page* 69.)

LET fig. 3 represent a lever of the second, and fig. 4 a lever of the third order. Let—

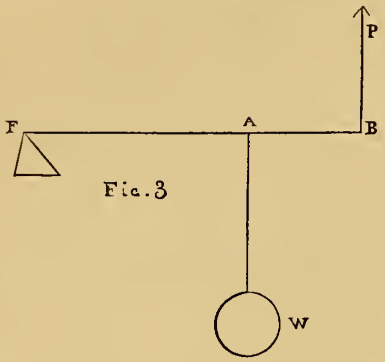

FIG. 3

F B ... ... = 6
F A ... ... = 4
W ... ... = 8
P ... ... = x

Then, we have in fig. 3, or lever of second order—

$$6 : 4 :: 8 : x$$

$$x = \frac{4 \times 8}{6}$$

$$= \tfrac{32}{6} = 5{\cdot}333$$

and fig. 4, or lever of third order—

$$4 : 6 :: 8 : x$$

$$x = \frac{6 \times 8}{4}$$

$$= \tfrac{48}{4} = 12$$

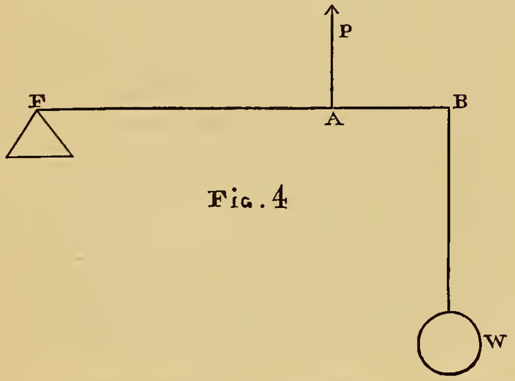

FIG. 4

because in the last case the power must be greater than the weight, and in the former the weight than the power.

The pressure on the fulcrum in the last orders of lever must be the difference of W and P.

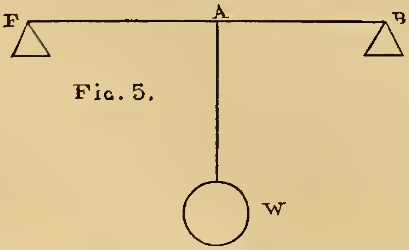

FIG. 5.

Let a rod (figure 5) rest on two supports, F, B, and a weight, W, be suspended at A, equal distance between F and B, then it will be evident that the pressures on F and B must be equal, and that F plus B (pressure) must also be equal to W, and hence the pressures on F=W—B, and the pressure on B=W—F, that is their difference. Now if we consider a power applied at B we do not alter the conditions, and have then a lever of the second order, and the pressure on F represents the pressure on the fulcrum.

APPLICATIONS TO THE GREAT WORKS OF CLOCKS AND WATCHES.

We have here to refer again to fig. 1. The line, *c b*, drawn from the centre of the drum to the point where the line or string assumes the vertical direction is equivalent to the shorter arm of a lever of the first order, and the line drawn from *c* to *a*, the point of contact of great wheel and centre pinion, is equivalent to the longer lever-arm; *c a* and *c b* being a straight line, and the centre of motion or pivots being between the weight and the power, what is the power the centre pinion sustains or receives at *a*?

Let the radius of drum ... ... = *c b* = 18
Radius of pitch circle of wheel... = *c a* = 20
Weight ... ... = W = 10
Power on centre pinion ... ... = P = x

Then x must be less than W, being applied on the longer radius at lever-arm, *c a*, hence—

$$20 : 18 :: 10 : x$$

and $$x = \frac{18 \times 10}{20}$$

$$= \tfrac{180}{20} = 9$$

And being a lever of the first order the pressure on the pivots is W + P

$$= 10 + 9 = 19$$

We will now consider the conditions of a great work where the weight is applied between the pivots of a drum and the centre (or intermediate pinion).

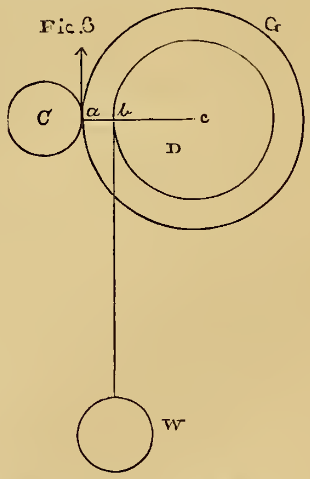

FIG. 6

Let fig. 6 represent a drum and great wheel of the same radius as fig. 1, but the weight suspended from *b*, in the line *c a*. We have therefore again—

$$c\,a : c\,b :: W : P$$

$$20 : 18 :: 10 : 9$$

But the pressure on the pivots is equal to the weight minus the power— $= 10-9 = 1$

The same conditions apply to the great works of watches by the application of the chain between the centre pinion and fusee, and on the outside of the fusee respectively.

When we consider the remarkable difference of pressure on the fusee pivots of the two modes, that pressure means friction, and friction wear, it is not to be wondered that Sir E.

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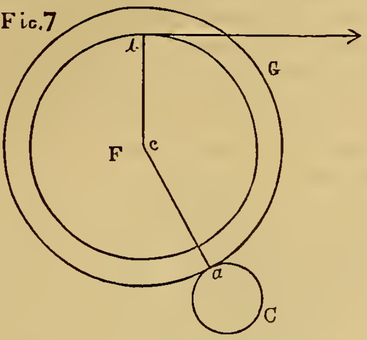
Beckett is startled by the fact that out of a thousand watches and chronometers 999 are still constructed on the later principle.

This makes itself especially evident in $\frac{3}{4}$ watches. Any intelligent watchmaker must have noticed that the top pivot and hole of a $\frac{3}{4}$ watch of this construction wear more than they do in a frame. A reference to the following figures will show this: —Let fig. 7 represent the fusee of a watch, G the great wheel, and C the pitch circle of the centre pinion; then *c b* and *c a* being very nearly in a straight line we have analogous conditions to that of the lever of first order. Fig. 8 represents the same fusee and great wheel, with the chain on the last turn, or the one of the smallest radius.

Fig.7



Let the radius of the pitch circle of the great wheel $c\ a$ = 9.9, radius $c\ b$ (fig. 7) = 8.5. Power communicated to centre pinion at a = 1, then W, represented by the pull of the mainspring:—

$$= \frac{9.9 \times 1}{8.5}$$

$$= \frac{9.9}{8.5} = 1.164$$

in fig. 8 let $c\ b = 4.25$

$$\text{then W} = \frac{9.9 \times 1}{4.25}$$

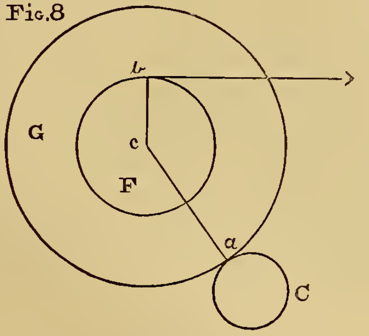
$$= \frac{9.9}{4.25} = 2.0329$$

and in fig. 7 the pressure on the fusee is—

$$= 1 + 1.164 = 2.164$$

and in fig. 8 $= 1 + 2.0320 = 3.0329$

Fig.8

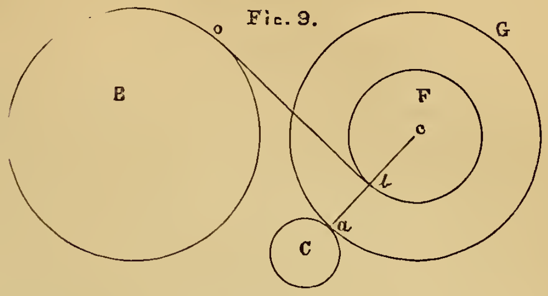


Let fig. 9 represent the great work of a watch with the chain applied between the centre pinion and the fusee pivots. We have then their positions reversed, B is the barrel, *b o* the chain, and C, F, and G the centre pinion, fusee, and great wheel respectively.

The radii *c b* and *c a* being of the same magnitude as in fig. 8, we have, when the chain is applied at the greater radius or first turn, the pressure = 1·164 — 1 = ·164, and when it is applied at the lesser radius or last turn = 2·0329 — 1 = 1·0329, and therefore the ratio of pressure on the pivots of a fusee, with the chain applied outside, to the pressure on the pivots of one applied between the centre pinion, as 2·164 to ·264 and 3·023 to 1·0329 respectively.

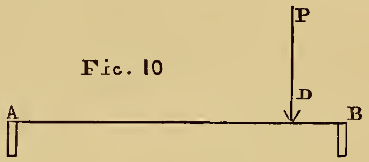
These quantities represent the total pressure on both pivots, which, however, is not equal on both, but proportionately to the relative positions of the chain.

Fig. 9.



Let A B, fig. 10, represent the axle or arbor of a frame fusee, A being the centre of pressure on the bottom, and B on the top pivot,

Fig. 10



D the point of application of the chain at the smallest radius. Let A B = 4, A D = 3·6, P = 3·0328 (see fig. 9). Let pressure on top pivot B = x; then—

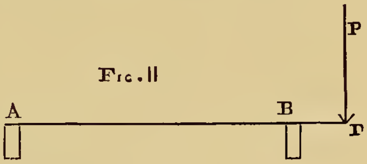
$$4 : 3{\cdot}6 :: 3{\cdot}0328 : x$$

$$x = \frac{3{\cdot}6 \times 3{\cdot}0329}{4}$$

$$= 2{\cdot}729$$

and on A = 3·0329 — 2·729 = 0·3059.

Fig. 11



Again, let fig. 11 represent the conditions of a three-quarter plate fusee, A B = the distance from bearing to bearing = 3·6, and A D = point of application of the chain = 4; then if x represents the pressure on B we have—

$$3{\cdot}6 : 4 :: 3{\cdot}0329 : x$$

$$x = \frac{4 \times 3{\cdot}0329}{3{\cdot}6}$$

$$= 3{\cdot}37$$

Taking the corresponding condition of fig. 9, we have pressure on top pivot

$$= \frac{4 \times 1{\cdot}0329}{3{\cdot}6} = 1{\cdot}14$$

This then demonstrates the fact that the pressure on the fusee pivot, when the chain is applied inside, is less by nearly two-thirds what it is when applied outside.

We shall notice this result again when we have friction under consideration.

(*To be continued.*)

QUERIES AND ANSWERS.

An Old Subscriber (Liverpool).—Will you or any of your readers be good enough to inform me which is the best method to restore Bezels that have gone back on French marble clocks, and oblige.

REPAIRING SWISS WATCHES.

No. IV.

By H. Ganney.

(*Continued from page* 62.)

We will now endeavour to indicate the more ordinary causes of failure and their remedies, as heroic remedies are neither profitable or necessary to the repairer, who is required to make the best of what is already in the watch. Deficiencies at both extremes of the movement constitute at least 90 per cent. of the troubles of watch work, want of freedom and security of the main spring and its immediate connections of click work and stop work form one large part, and want of freedom for the balance and its immediate connections with the escapement constitutes the other portion. The most interesting feature connected with Swiss work, the excellent system by which they produce the horizontal escapement, constitutes a perfection of production that has not been surpassed by the highly extolled American system, who have applied to all parts of the watch the same plans which enables a repairer of Swiss watches in any part of the world to send a part of his escapement, or its number on the gauge, to any material warehouse, and receive a corresponding part which may be easily and surely fitted without fear of error or necessity of alteration.

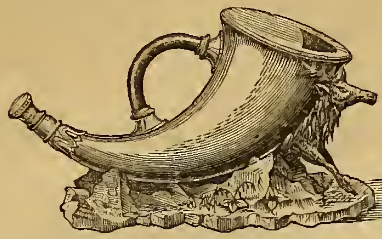
American watch and clock production should be impossible for another century; by the laws of true political economy and relative value of labour in the old and new worlds, and owes its existence to the fact that the English and European worker or producer has no faith in himself or his future; untaught by past experience he refuses to extend his appliances, except under compulsion. He makes wheels and pinions by reproductive tools, because these cannot be perfectly produced by the file and hand tooling, though in clock pinions, even now in England, only the spaces are cut by the engine, and the rounding the pinion must be done with a file by hand. This fact illustrates the peculiar spirit so long dominating the trade, and accounts for the absence of the clock manufacture from the list of modern English trades; it is necessary the watch repairer should understand and appreciate these ideas, as he is called upon to counteract or remedy, on the mass of cheap work, not damage or wear, but faults of construction, and errors arising therefrom; some parts of ordinary Swiss watches are not mechanically adapted for the work they have to perform. The whole of the barrel work generally is essentially unsound and rotten, even in horizontal work, and when additional trouble is added with the strong lever main spring and escapement to the same calliper, endless is the annoyance thereof It is often urged by apologists the Swiss click work is well enough if very well made; and if main springs are weak and all parts sound this is no argument, as a good mechanical device will stand the test of cheap and rough construction and usage and still give useful results. Ratchets, which are efficient in proportion to their size, are now not more than half the diameter they used to be made, and, as a consequence, have not half the retentive power over the main spring or strength of teeth and click. Looking at old Swiss make of watches, such as Lepine, we see the ratchet, just free of centre wheel, which is what restricts its diameter, which may otherwise be as large as the barrel, as is the case in keyless watches, with advantage. It is an axiom in other than Swiss centres of manufacture, never to wind a main spring more than half a turn, lest something happens, and the rapidity with which a new watch is passed on to somebody else, as soon as it ticks is the only explanation, that can be given of the neglect of this portion of the Swiss watch, making it usually more unstable and delicate than the much abused and unnecessary fusee and chain and maintaining work, with its thousand parts and complications. We quite despair of indicating to the young repairer the means of rectifying the errors of this part of the watch. A ratchet and click that fails is not made secure by refiling its worn teeth and click. As diameter is more diminished, if excessive strength of click spring is the cause of the ratchet cutting it, it should be weakened by filing its spring; and in reshaping the click, see no angle is formed that may cause the ratchet to drive the click up out of the teeth or down on the barrel, and that a good steady pin or pressure on the plate keeps the click steady, and that its screws and the bar screws are perfectly reliable. The hole and bars for sustaining and covering the barrel arbor are usually too thin, and of insufficient thickness, both for a sound hole for the arbor to work in or to hold the four screws which secure the whole together. These screws as often as otherwise being transformed into rivets, the watch cleaner not caring or able to secure a holding otherwise. A radical reform in this part of the watch, may be effected when the barrel bar is too thin to hold a screw thread properly, by reversing the screws and putting a new small bar of good brass or steel, in which the screws are tapped, the heads being carefullly countersunk and freed of the barrel. This method, if adopted in making all bar watches originally, would be a great improvement, and save much trouble and unsoundness. The stop work is such a frequent cause of failure that a majority of the watches in wear have them removed. A badly made stop work is generally not capable of being repaired. The usual plan of making the pieces equal size, or the upside down piece the largest, is the great cause of trouble, producing a gearing as likely to stick as to revolve. The action is really the same as a series of roller and lever actions, and the points so important to freedom and safety of action are the same. Putting a larger star wheel, and reducing the size of the comet wheel, will generally secure a good stop work. Considerable difficulty will be found in turning the comet true, and there are tools attached to some lathes for reducing it, after the manner of a wheel cutting engine, with a cutter working at right angles to it. But a very good job may be made by turning a ring in its surface, and filing up to it in the hand, and finishing it off in the turns with the graver and burnisher. The smaller the circle of the comet the safer and less likely to stick are the arcs of the star wheel, which should be fitted with least possible amount of side shake, and all sharp corners carefully rounded. If the screw and socket are damaged a hollow stopping should be rivetted in the barrel cover, and the screw dispensed with, the hub for the star wheel to work on being turned true on an arbor, and slightly undercut, and the star wheel being slit through and forced over the boss, like an index on a cock; this is the method used in fitting the best stop works to English going barrels, and is quicker and sounder than the screw, which lacks both strength and freedom, and often works out by the action of the pieces.

(*To be continued.*)

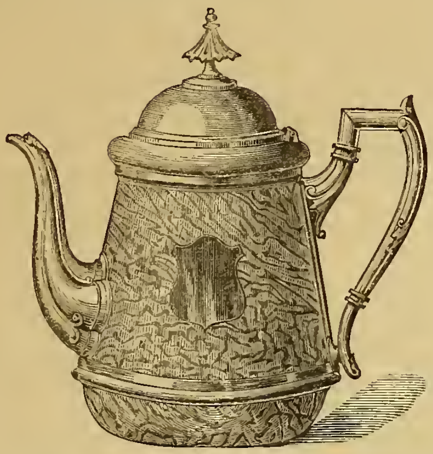
NOVELTIES IN TABLE-WARE.

Messrs. JOSEPH RIDGE and CO., silversmiths and manufacturers of electro-plated and Britannia metal goods, of Lion Works, 47, Eyre Lane, Sheffield, have sent us specimens of some novelties, represented by the annexed cuts, which deserve the attention of the trade. The teapot is of enamelled iron with plated mounts, and looks very elegant.

This ware is manufactured also in coffees, sugars, creams, water-jugs, etc.; and its effectiveness, lightness and durability —it is almost indestructible—will make it most welcome to housekeepers; in fact, we know of no other article that will give as much satisfaction for the same price.



We have also received from the same firm some well-got-up prints, illustrating their new ivory and wedgwood ware, both very handsome goods of new design. This wedgwood ware is already very popular, and certainly deserves to be so, while the hand-painted ivory ware needs only to be seen to secure public favour also, and we think them certainly a profitable line for shopkeepers to keep.



Messrs. Ridge and Co. are the patentees and manufacturers of the new non-conductor handle for tea and coffee-pots and the registered strainer, a very simple and effective arrangement capable of being applied to any tea or coffee-pot.

THE CROWN JEWELS OF FRANCE.

Uncompromising Republicans may rejoice, admirers of Monarchical institutions may experience a vague feeling of regret, while amateurs of gems will wonder at the announcement that the French Government have determined to submit to the Chambers a proposition to sell the Crown jewels of France. It is the opinion of the Ministry that the precious stones in question do not possess any historic value, and that the proceeds of their sale may be usefully devoted to extending and improving the national museums. The surprising feature in this announcement is the official statement that the value of the Crown jewels does not exceed five millions of francs—say two hundred thousand pounds sterling. Just before the fall of Napoleon III., the jewels preserved in the Imperial Garde-Meuble on the Quai d'Orsay were valued at more than five times the actual computation, a "parure" of Oriental pearls alone being appraised at a million of francs. A very high figure, also, was set on the Sancy diamond; and the prodigious sum of twelve millions of francs, or four hundred and eighty thousand pounds, was calculated as the worth of the world-renowned "Regent" or "Pitt" Diamond. Surely some "historic" value attaches to this memorable stone. All readers of Pope remember the ill-natured and calumnious couplet about the Indian who sleeping lay, and the crafty merchant who stole his gem away; but the plain truth is that, although it is not known with precision in what part of India—some say in Malacca—the fourth largest diamond in the world was found, it was purchased in quite a legitimate manner for the sum of twenty thousand four hundred pounds by Thomas Pitt, grandfather of the first Earl of Chatham, and Governor of Fort St. George, in the East Indies, in the reign of Queen Anne. It weighed four hundred and ten, and when cut one hundred and thirty-six carats, and on being brought to London and converted by the lapidaries into a brilliant it was sold in the year 1717 to the Regent Duke of Orleans, to adorn the crown of the baby Louis XV. The lapidary work took two years to execute, and cost three thousand pounds, while upwards of five thousand pounds—of which a considerable proportion is said to have gone into the pockets of the infamous Cardinal Dubois—were spent in the negotiations for the purchase. The price paid by the Regent was one hundred and thirty-five thousand pounds, certainly a very handsome enhancement of the amount given to an anonymous Indian trader by Governor Pitt. Napoleon I. had the splendid bauble mounted in the hilt of his sword; but from this at the Restoration the gem was taken to adorn the centre of the circlet of the crown worn by Charles X. at his coronation at Rheims. Looking at the known value of the immense brilliant—which is, nevertheless, far surpassed in size by the great Lazareff or Russian diamond, which weighs two hundred carats, and was originally the eye of an Indian idol, and by our own peerless Koh-i-Noor, or Great Mogul, the weight of which is two hundred and seventy-nine carats—and at the interesting historic associations connected with it, the inference is reasonable that the French Government have no intention of asking for legislative authority to sell the Regent diamond.

The vessel of the French State has been so terribly tossed about in tempests political during the last hundred and ten years that it is almost a matter for surprise that there should be any Crown jewels in the Garde-Meuble at all. The purchase of the Pitt diamond only four years after the conclusion of the Peace of Utrecht, when France was left bleeding at every pore, and with her finances to all appearance in a bankrupt condition owing to the War of the Succession, has often been quoted as a proof of her recuperative powers, and the comparative ease with which she can recover from seemingly overwhelming military and pecuniary reverses. On the other hand, the transaction might be cited as an illustration of the cynical indifference to the sufferings of an indigent people exhibited by the Regent d'Orleans in lavishing a huge sum of money, which would have given bread to thousands, on a trinket for the brow of a child still in the nursery. The transaction, notwithstanding, was quite in keeping with the traditions of splendidly overweening selfishness with which the idea of French Royalty was then surrounded. What could be fitter than that the circlet of sovereignty with the Pitt diamond should adorn a Royal Little Boy whose juvenile copybooks are yet preserved in the Library of the Hermitage at St. Petersburg—one of them being headed with the exemplary maxim, "Kings do as they will; their subjects obey them." When the Royal Little Boy was taking exercise with his nurse one afternoon on the terrace at Versailles, a great noble of the Court took the child in his arms, and, pointing to the great concourse of people in their holiday dress—it was a fête day—in the gardens, said, "Behold, my King! all those men, women, and children, their money, their prosperity, their lives belong to you." Clearly, although France might be insolvent—and chronically insolvent she continued to be until the cataclysm of the Revolution and the assignat system brought utter bankruptcy, from which she arose permanently refreshed by ruin—it was indispensable that the King, to whom more than thirty millions of people "belonged," should have a crown worthy of his autocratic supremacy. It was the Sieur Rodé fils who made the last Royal crown of the "ancien régime." It weighed thirty-two ounces and contained two hundred and seventy-three diamonds and sixty-four coloured gems. The circlet of very thin-beaten gold was adorned with brilliants, rubies, emeralds, and sapphires; the branches or arches sprang from eight flowers de luce; the basis of the crest was a row of pearls between two rows of brilliants surrounded by a double flower de luce, of which the pear-shaped summit was the "Beau Sancy," a rose-diamond of two hundred and twenty grains. The inner cap, or "calotte," of this gorgeous badge of sovereignty was of violet satin, embroidered with gold, and enriched with seventy-five diamonds. The Crown Royal, manufactured by the Sieur Rodé fils, exists at present only in the portfolio of the collector of old engravings. The portrait of this vanity of vanities was duly taken for the edification of posterity; but the thing itself is clean gone—as completely vanished as the more renowned diamond necklace, the story of which has been so picturesquely narrated by Mr. Henry Vizetelly, and the gems in which, according to Mr. Carlyle, "streamed down together," "like lambent zodiacal or aurora borealis fire."

That famous, or rather infamous "Collier de la Reine" had its origin in a whim of Louis XV., who, in his infatuated dotage, wished to bestow on Madame Dubarry the costliest set of diamonds that could be collected throughout Europe. Shameless as he was, he hesitated to present the "Regent" or the "Sancy" to his mistress, but otherwise the Royal spendthrift gave "carte blanche" to the Court jewellers, Böhmer and Bossange, who ransacked the diamond markets of the world to produce a necklace which they valued at two millions of livres. How Louis XV. died from one of the most horrible forms of small-pox; how Böhmer and Bossange, fallen into difficulties through their inordinate purchases of jewels, vainly strove to sell the "Collier" to the young Queen Marie Antoinette; and how they were ultimately swindled out of the precious necklace by the notorious Madame de la Motte and her associates are matter of history. The diamond necklace disappeared piecemeal. Its counterfeit presentment is likewise extant in engravings, but the article itself is no more. It vanished. The Crown Royal of France was not long in following it; but, strangely enough, throughout all the vicissitudes of the Revolution, and notwithstanding the terrible straits for money to which the successive Republican Governments between 1791 and 1800 were reduced, the State never lost its hold on the "Pitt" and the "Sancy" diamonds. Indeed in one sense the Republican rulers of France were conservators rather than destructives. They melted down all the church bells to make "sous" of, and cast the lead of all the coffins in the Royal Tombhouse at St. Denis into bullets. They sowed potatoes and mangold-wurzel in the gardens of the Tuileries, and allowed the mob to demolish scores of castles and abbeys; but they did their best to preserve the furniture and ornaments of the Royal palaces from annihilation, and between the cessation of the Reign of Terror and the termination of the rule of the Directory an immense collection of jewels, furniture, and objects of art were brought together. There were not enough gems, however, to furnish forth the diadem of a new Monarch; and Napoleon I. was fain to entreat the well-known jeweller, M. Edmé-Champion, to give him credit for that Crown Imperial which, metaphorically, the Corsican adventurer confessed that he had "picked out of the kennel." But the crown which had encircled the brow of a Bonaparte was deemed unworthy to press the forehead of a restored Bourbon. Louis XVIII. elected to be taken as crowned"; and for the "sacre" of Charles X. a new crown was made. The jewels in it have long since been separated from the body of the diadem; and the "Regent" was displayed in an isolated state in the Paris Universal Exposition of 1878. Neither Louis Philippe nor Napoleon III. was ever crowned; and the contingency of any future Head of the State in France requiring the services of a Sieur Rodé fils or of an Edmé-Champion appears, to say the least, extremely problematical. Old crowns partake, to a considerable extent, of the nature of old clothes, and are not exempt from the same vicissitudes to which cast-off garments are liable. Still the "Regent" is worth more than a disused overcoat, and cannot so easily vanish into space.—*Daily Telegraph.*

THE CORUNDUM MINES, MACON COUNTY, N.C.

THESE mines are situated on the Sugar Fork River, a tributary of the Tennessee, nine miles from Franklin. They are owned and worked by the Hampden Emery Company of Chester, Mass. A considerable part of the ore is roasted for the purpose of more easily separating the corundum from the accompanying rock. When sufficiently burned, the ore is conveyed to the stamps, crushed and carried by a stream of water into troughs to be washed. A portion of the ore is then jigged, the corundum settling on the bottom; the lighter stuff, rising to the top, is skimmed off. The richer ores are cleaned by simple washing. From the jigs the corundum is placed on a drainer, and when sufficiently drained is taken to the loft, spread, dried and sacked. The corundum is then hauled sixty miles to Mt. Airy, a station on the Charlotte and Atlanta Railroad.

The first mine reached is an open cut. It is situated on a steep hill-side, about one hundred feet above the mill. The vein, though quite irregular, appears to have a width of from three to four feet.

The corundum in this vein is enclosed in that variety of chlorite called ripidolite and jeffersite, associated with tremolite and spinel. The corundum occurs in both cleavage and crystalline form, the crystals often having perfect terminations, while many are transparent, and constitute the true Oriental sapphire, ruby, emerald, topaz, etc. Among such gems have been found an emerald weighing 30½ carats, and a ruby weighing 10 carats.

Two or three hundred yards south, and apparently on the same vein, is another opening of about one-hundred feet in length, from which about one hundred tons of ore have been taken. Lying on the east side, and running parallel with this vein, is a continuous vein of beautiful light grey corundum in crystals, from the size of a goosequill to that of the finest cambric needle.

The corundum taken from this vein is so entirely free from foreign matter, that it requires very little manipulation to prepare it for use.

At the top of the hill, and two or three hundred feet above the former, is still another open cut, twelve feet wide and fourteen deep. In portions of this vein are found large bipyramidal crystals similar to those from the Carnatics in the East Indies. This vein appears to have regular walling made up of tremolite, and carries corundum, spinel, and nearly all the varieties of chlorite. South-west of this and probably on the same vein as the last, is another mine which has been more extensively worked than any of the others.

The vein is sixteen feet wide, and is uncovered for a distance of ten rods. The rock is so far decomposed that it can without difficulty be mined with a pick.

A tunnel is run in the centre of this vein to a distance of twenty feet; connected with this tunnel, at the farther end, is a shaft eighteen feet in depth. This tunnel and shaft was originally made for the purpose of drying the walls of the vein before removal. It is now used as an oven for drying and roasting the ore. The varieties of chlorite associated with the corundum contains water of crystallisation and exfoliates when heated, rendering it more easy to separate from the corundum. Since the first opening of this mine more than six hundred tons have been taken out; two-hundred tons of this since April 1st, 1880.

CONSTRUCTION OF TIMEKEEPERS DELIVERED TO THE BOARD OF LONGITUDE, MARCH 7, 1805.

Earnshaw's Escapement.*

THE escapement is detached, and the best of all others for an equal measure of time; because the vibrations of the balance are free from the friction of the wheels, in the manner here adopted, except about one-twelfth part of the circle, whilst the scape-wheel acts on the pallet to keep up the motion of the balance, which is done with considerably more power and less friction than by other escapements because it receives but one blow from the wheel, whilst the escapements receive two; it has also an equal advantage in the quickness of train, and when the impulse is given to the balance by the wheel, it is given in a similar direction and not in opposition, as most escapements are which produce recoil. This is clearly proved by its causing a heavier balance to vibrate to a greater distance. The escapement should be made in the following manner:—

The pivots of the balance axis should be the size of the verge-pivots of a good common sized pocket-watch of conical shape, which will greatly add to their strength, the extreme end, or acting part, only being straight; the jewel-hole should be as shallow as possible, so as not to endanger cutting the pivot, and the part of action of the hole made quite back, with only a very narrow chamfer behind to retain the oil; deep holes are very bad, for when the oil becomes glutinous, it will make the pivots stick, so as to prevent the balance from its usual vibration. The pallet should be half the diameter of the wheel, or a little larger, for if smaller, or one-fourth of the diameter as Arnold's is, the wheel will then have too much action on it, which will increase the friction considerably, and likewise cause the balance to swing much farther to clear the wheel; consequently a check in the motion of the balance may stop the watch, and this, doubtless, often causes timekeepers, so constructed, to stop. The face of the pallet should run in a line of equal distance between the centre of the pallet and its extremity, and not in a right line to its centre, as this causes an increase of friction, and a loss of that power which is obtained by the wheel acting on the extremity of the pallet. This is clearly proved by time, from the holes worn by the points of teeth in all pallets that run in a line to the centre. The scape-wheel teeth should form the same direction as the face of the pallet, under cut for the said purpose of avoiding friction, and maintaining the power, and for safe locking. The points of the wheel teeth must not be rounded off, but left as sharp as possible. The pivots of the scape-wheel are to be a very little larger than the balance-pivots.

The wheel is locked by a spring instead of a detent with pivots, as the French have made them; for those pivots must have oil, and when the oil thickens, then the spring of the pivot detents is so affected by it as to prevent the detent from falling into the wheel quick enough. The consequence of this is irregular time and stoppage of the watch; and if ever such a watch went well for twelve months, accident must have favoured it.

When the spring is planted on the side of the wheel, as in this escapement, the part on which the wheel rests should be a little short of a right angle, so that the wheel may have a tendency to draw the spring into it; for if sloped the other way, or beyond a right angle, it will have a tendency to push the spring out, in that case the wheel will have liberty to run. The wheel should take no more hold on the spring than just sufficient to stop it; for if more, friction will be increased. The small return spring should be as thin as possible at the end fastened to the other spring, but at the outer end a little thicker; the spring should be planted down so close to the wheel as only to be just free of it. The discharging pallet about one-third, or nearly one-half the size of the large or main pallet, the face of it in a right line to the centre, the back of it a little rounding and off from the centre. Great care must be used in taking off the edges of this discharging piece, to make it round to prevent cutting the spring, nor can it be made too thin if it will not cut; the end of it nearest the balance should be a little more out from the centre of the balance axis than the lower part of it towards the potence, for counteracting the natural tendency of the spring downwards from the pressure of the scape-wheel; and that part of the spring on which the wheel rests should be sloped a little down, to give the wheel a tendency to force it up, to counteract the natural inclination the wheel has to draw it down by its pressure on it.

The balance is to be made of the best steel, and turned from its own centre to its proper size, then put into a crucible with as much of the best brass as when melted will cover it. The brass melted will adhere to the steel (if any other metal is used by way of solder, the watch cannot go well); then turn it to its proper thickness, and hollow it out so as to leave the steel rim about the thickness of a repeating spring to a small sized repeating watch; turn the brass to twice or nearly three times that thickness of steel, cross it out with only one arm straight across the centre. At each end of the arm fix two screws opposite to each other through the rim of the balance, to regulate the watch to time; the diameter of the heads of these screws about equal to the thickness of the balance, a little more or less is not material. The compensation weights should be made of the best brass and well hammered, and a groove turned to let the rim of the balance into it, and this should be cut into fourteen equal parts by a wheel engine; then you will have seven pairs of pieces of equal size and weight; two of these pieces being screwed on to the rim of the balance at equal distances will produce an equilibrium, a balance in the full sense of the word, equal in all its parts. In making balances great care should be taken that they get no bruises or bendings, for if they get a bruise on one side so as to indent the metal, that part will be less affected by heat and cold than the other parts which have not received the same violence to close their pores; consequently the balances made by rule of thumb, bending, hammering, and filing, without one single truth about them, must to the poorest mechanic be inconsistent in the extreme, as no worse method can be taken, and the piece can only go well by some error compensating for others; for should there be one stroke of the hammer on the compensation piece on one side of the balance more than on that on the other, heat and cold will produce different effects on them; and if the two metals which compose the compensation for heat and cold be soldered together it is still worse, as then the compensation will be composed of three metals instead of two, three acting bodies as follows:—The brass has a tendency with every change in the atmosphere to move one way, the steel has a tendency to move the same way, but not so rapidly as the brass; but the force of the brass warps the steel with it. Here, then, they might act pleasantly together, but the middle or soldering metal, between the brass and steel, having a greater tendency to rapid motion than the other two, and being confined between them, will undo that natural easy accordance which they without it would have possessed, and will act as a third man between two men of equal force, but not so rapid in action as the middle one, warping with him either way his inclination is to move, and the said natural easy accordance in two metals, so necessary to obtain perfection, must not be destroyed by a third.

(*To be continued.*)

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* Earnshaw's own description from "Smith's Compendium of Practical Inventions." Liverpool, 1816.

HALL-MARKING.

THE *New York Jewelers' Circular*, in discussing our system of hall-marking and the endeavours now being made in this country by a large section of the trade to abolish the hall-marking laws, writes :—

"We say to the honest manufacturers of Great Britain, hold on to your hall-mark; do not relinquish a fraction of the security it throws around honest goods; on the contrary, make the law more stringent if possible; increase the penalties for forging or evading the hall-mark; and, further, prohibit all foreign-made goods from using the stamp; make your hall-mark purely and essentially a distinct British institution, and preserve it for the sole use and benefit of British artisans. All the evils that the trade suffers from in this country arise from the fact that we have no stamp of value; no national symbol by means of which non-expert purchasers can distinguish the genuine from the spurious. The longer you permit our manufacturers to use your hall-mark on the goods they manufacture for foreign consumption, the longer you delay the adoption by this country of a standard for wrought gold and silver, and the enforced use of a stamp of quality. Every tub should stand upon its own bottom. American made goods are as distinctively American as French goods are French and German goods German. As they have their peculiarities of design, form, workmanship, and value, so they have, also, their peculiarities of quality. They should carry with them a certificate of quality—of the genuineness of the metal. This assured by a stamp of quality, persons can exercise their own judgment as to the value of the workmanship expended upon the metal. It is in the substitution of degraded metal for the pure article that the deception lies, and this deception is only discoverable by the application of tests that are beyond the reach of the ordinary purchaser. Because we have no national standard of wrought gold and silver, and no stamp of metal value, fraud and deception run riot in the trade. Goods made of 8 or 10 carat gold are brazenly marked 14 or 18 carat, and sold as such; the best designs of our most skilful artisans in genuine goods, are fraudulently copied in debased metal, and exposed side by side with the genuine. Rolled plate and filled goods are palmed off by unscrupulous dealers for pure gold, and the public is deliberately swindled. Frequently the dealers themselves are imposed upon by the spurious articles, and made the innocent confederates of dishonest manufacturers. The only barrier now existing between the purchasing public and these dishonest practices is the reputation of the seller, and this, of course, avails nothing with strangers. A few manufacturers have adopted trade marks, but, unless the goods are bought direct from them, the trade mark is of little value, because it can be so nearly imitated without legal liability as to utterly deceive buyers.

"The only remedy for these bold and outrageous swindles is the enactment by Congress of a law prescribing fixed standards for wrought gold and silver, and providing that all goods sold shall either be stamped to indicate the quality of the metal of which they are composed, or be accompanied by a certificate to the same effect, for which purpose a bill of sale should be considered a certificate. Severe penalties, embracing fines, imprisonment and forfeiture of goods, should be provided for violations of the law. Such a law need not prohibit the manufacture of cheap goods—for which there is a legitimate demand—but it would prevent the sale of 10 carat goods as 18 carat, and of rolled plate or filled goods for genuine gold. Let us have our own system of marking, our own certificate of quality, and it will not then be necessary for American manufacturers to secure the British hall-mark upon their goods to assure foreign purchasers that they are not being made the victims of Yankee trickery. The Birmingham daily *Globe*, according to Mr. Poole, asserts that in 1878 thirty thousand American watch-cases were stamped at Chester with the British hall-mark. That is to say, American manufacturers had to get a British certificate as to the quality of the metal of which these cases were made. Without such certificate, American goods would be unsaleable in foreign markets. This is a disgrace to America, and an insult to American manufacturers. No matter how much superior in point of artistic design and workmanship our goods may be, they will not pass abroad unless they have the British stamp of quality. That this is a fact, is all the evidence necessary to the value of such a system. The hall-mark of the Goldsmiths' Company, sanctioned by the laws of Great Britain, upon gold or silver goods, is received throughout the world as a certificate of quality quite as readily as is the impress of the British mint upon a gold or silver coin.

"But beyond the fact that the hall-mark is notice to all the world of standard quality, it prevents the imposition upon the public of base metal for genuine. This stamp is affixed by experts who are not interested in the manufacture; the maker of the goods has no voice in placing the mark upon his wares; he sends them to the designated place to be marked, and they are returned to him indelibly stamped with a symbol that indicates to all observers their quality. To counterfeit this stamp is forgery, consequently, manufacturers of cheap goods are unable to impose upon buyers as to their quality. Here the reverse is true, and while nine out of ten of our manufacturers are honest, and sell their goods for just what they are worth, the tenth man fills the market with spurious goods, and makes extraordinary efforts to sell them.

"There being no law to prevent him, he can lie about them to his heart's content, and, having no conscience, swears, with the utmost alacrity, that 6 carat goods are 14 carats fine, and that filled goods are solid gold. Further, he will stamp "18 k." upon goods that are nine-tenths alloy, without changing a muscle or winking an eye. By actual assay, cases marked 18 carats fine have been found to contain less than 8 carats of gold, yet the public has been deceived into paying the price of 18 carat goods. Surely, Congress owes it to the citizens of this country to protect them from such barefaced swindles as this. Mr. Poole is doing good service in fighting for the maintenance of the hall-marking system. We wish some equally energetic champion of honest dealing would turn up in this country to urge upon Congress the necessity for a similar system here."

THE ART OF THE SILVERSMITH.

By W. Herbert Singer.

(*Continued from page* 70.)

IN 1659, at the visitation of Matthew Parker, he inquires if within the diocese of Canterbury, "they do minister in any prophane cuppes bowles dishes or chalices hitherto used at masse, or els in a decent communion cuppe provided and kept for the same purpose only." The consequence of this untiring search is the almost entire destruction of pre-Reformation ecclesiastical silver-work.

"The fair and comely communion cup of silver, and a cover of silver for the same, which may also serve for the ministration of the communion bread," which the Commissioners of Queen Elizabeth directed to be used in every parish in England, is too well known to need much description. Numerous examples are to be met with all over England. It is very remarkable what exact uniformity of design was always maintained in these Elizabethan chalices. The bowl is always of the same elongated form, somewhat resembling an inverted bell. As the feeling became less Popish, so the bowl of the chalice was made to turn outwards at the edge, until at length it was almost the shape of a goblet. Round it is an engraved band composed of two double lines, which interlace in precisely the same way in nearly every example, the space between being filled by a running pattern composed of conventional foliage. The stem is still divided into two parts by the knop, which is, however, much smaller. The foot is now always round, and some of its mouldings are worked into small flutings. It will be seen that it is an object to which the term cup is more applicable than that of chalice, especially as no sacred monogram, or other emblem to mark their religious use, is often found forming part of the ornamentation of the communion cup.

The similarity in shape and design of these vessels seems to point to some regulation pattern being at one time ordered, but no such injunction has yet been discovered. These chalices were mostly made in London, Norwich, York, and Exeter, a very slight deviation in the shape of the bowl being observable in those made in the various localities. The Norwich chalices are noted for the greatest divergence from the usual pattern. The silversmiths of this city made the bowl wider and with straighter sides than is found elsewhere. This form of communion cup continued in favour until about the middle of the next century, but after 1,600 the type degenerates.

Flagons, which came into use during the reign of Queen Elizabeth, and took the place of the cruets of former days, became now a necessity of the time from the increased use of wine at the communion. Some of these were of great size; two in Frome Church lately turned into other church plate held nearly a gallon each. These were long straight-sided vessels, with good bold bases and well shaped covers, the average quantity of wine used at this church in 1575, for the ten communions in one year, for a population of 5,000, being fully "ten quarts of sacke" upon each occasion!

When we turn to secular plate, we find that the hanap was the object upon which the silversmith could best display his artistic power and skill of execution. There is a beautiful specimen at the Mercers' Hall, which illustrates the style at the beginning of the century. It is also interesting as being the earliest known that is hall-marked. The Elizabethan hanap, although not so well known as the chalice of the same date, is still to be found in the cabinet of many collectors of old English plate, the style of ornamentation being very similar to that upon the chalice.

During this century the salt-cellar was made in various shapes. The first type was that known as the hour-glass salt. About the middle of the century it became an object of more beauty and importance, being generally square and highly enriched with *repoussé* and engraved work. At the end of the century, we come to the circular or bell-shaped salts. These were made in three tiers, the two lower compartments holding the salt and the upper forming a pepper-castor. Although not deficient in ornamental effect, it cannot be favourably compared to the types before mentioned.

The rose-water dish gave the silversmith every scope for displaying his power of design, and from remaining examples we see that of this, by many, every advantage was taken. This is the case in a beautiful specimen belonging to the Merchant Taylors' Company. In the centre is a coat of arms in high relief; round this are six panels, containing alternately dolphins and conventional vegetable forms, all executed in *repoussé* work. The mazer bowls also received enrichment from the silversmith, the silver rim placed round these wooden bowls to increase their depth being often highly decorated.

It was during this century that apostles' spoons came into such general use, it being the fashionable christening present of the period, the wealthy giving a complete set, and the poor a single spoon, having upon it the patron saint of the donor, or the saint in whose honour the child is named. During the time Holbein was Court painter in this country, he found leisure to make some beautiful drawings for gold and silver work; but although these drawings are most exquisite designs for silver objects, none of the English silversmiths seem to have been sufficiently skilful to follow the example set them.

The most important productions of the silversmiths in England during the seventeenth century were the large drinking vessels known as grace cups, or loving cups. These are all very much alike in style, generally being composed of a bowl covered with ornament in low relief, surmounted by a cover of open or pierced work, and in form somewhat resembling a steeple; the stem is often composed of acanthus leaves, with baluster-shaped mouldings, the foot being round, and some of its members ornamented with flutings; others with a small running pattern. Many of the City Companies still possess examples of these grace cups, and they often bear the name of the warden who presented them to the company.

Repoussé work in high relief seems not to have come much into fashion before the time of Charles II., but after his time the large tankards, and particularly candle cups and trays, were covered with bold *repoussé* work, to the exclusion of the former style of James and Elizabeth. During this century a large amount of engraved ornament was applied to smaller objects, especially to watch-cases.

As the use of wine became more general in the Church of England, so the chalice increased in size. In many places we find a kind of grace cup or hanap amongst the Church plate, probably the gift of some rich parishioner. These large cups, with covers, were silver gilt, with ornamental open work forming the stems. These vessels, which have, as yet, received but little attention, considering their interest and beauty, are mostly of the first quarter of the seventeenth century. A very fine one is to be seen at Yarlington, in Somersetshire, another at Horsington, in the same county, and there is also one at Fisbury, in Wiltshire. The height of the Horsington cup is 20 inches, and the bowl is five inches in diameter, this being about the usual size for these vessels. The ornamentation on the cover is similar to that in the Yarlington cup, showing a common type. These hanaps were probably used as a supplemental chalice, as the ordinary vessel would not hold enough wine in these imbibing times. No doubt many of these interesting specimens would be found were our country churches searched.

In the reign of Charles I. was continued, and probably for the last time practised, a custom most beneficial to this industry. On every New Year's Day each noble lady, and every member of the Royal Household down to the knight, was accustomed to offer the king a present, according to their station. At this time, in fact, all the Royal servants of gentleman's rank gave a New Year's gift, in proportion to the rank they held, generally doing so in kind; that from the nobles, however, being in money. Thus Dr. Harvey (the discoverer of the circulation of the blood) gives a box of marmalade, and he has sent him in return a present of 24 ounces of plate, each person receiving as an acknowledgment some work in silver, according to the largeness of their offering. In 1640, forty-two persons, members of the household, had presents in silver. The sergeant of the scullery gives a basket of coals, and receives 10 ounces of plate; and one giving a red Turkey carpet receives a present weighing 300 ounces; the gift from the king being usually half the value of the present he had received from his subject—the honour of giving an offering to so exalted a personage having to compensate the donor for the other half.

(*To be continued.*)

NOTICE.

TO JEWELLERS and WATCHMAKERS.—Advertiser, aged 19, desires to enter a good House to learn the Trade generally; salary no object; excellent references.—Address, E. S., 443, Fulham Road, S.W.

CLOCK and WATCH JOBBER.—A Young Man seeks Situation in London as above.—Aggett, Office of this Paper.

TO WATCH MANUFACTURERS.—The Patentee of important Improvements in Going Barrels desires to meet with a firm that would introduce his invention.

The advantages are *substantial,* and are such as will be *thoroughly understood and appreciated by the trade,* and *by the public,* so that a large demand is certain to arise. Address—The Editor, Office of this JOURNAL.

WATCHMAKER and JEWELLER'S BUSINESS.—To be Sold, by order of executors. An excellent business with shop in a good position close to Oxford Street.—Apply to Messrs. GEORGE G. HINT and PERKS, 18, Duke Street, Manchester Square, W.

THE POCKET RATING OF WATCHES.

MANY watchmakers have long felt the difficulty and trouble of rating on the bench the finer class of instruments sufficiently near for pocket satisfaction. Under the maker's eye they have given good results; but after being transferred to the pocket of the customer the going has been so different that unpleasant calls have had to be made for the purpose of being "regulated." Such calls are disagreeable to both maker and wearer, and are attempted to be got over by the maker carrying the watch a few days or so himself, and doing the best that can be done in that way, either by his own regulator or the Post-office clock, according to the place where he may be established.

In order to remedy such a defective condition of this kind, a department has been opened in connection with this journal, that has for several years been privately tried in a limited way with much success. That is, that watches will be received, worn in the pocket, and otherwise subjected to regular work, as if the customers had them. They will be in the pocket on railways, omnibuses, cabs, walking, etc., about fifteen hours a day. They will be rated by the time wire of the Greenwich Observatory standard clock, and a mean weekly rate of performance will be kept and supplied at the termination of the trial to the owner. The rating-paper will be signed by the gentleman conducting that department, and it may be published or not, at the discretion of the owner. It is to be clearly understood that the "regulation" of the watch will under no circumstances be meddled with unless at the desire of the maker, but in that event he may rely upon its being done by a competent hand. The period during which the rating will be carried on will vary from one to two months as the watch may happen to steady itself to its work. As only a limited number can thus be on trial, makers are requested to bear this in mind, and send types of classes of their manufacture. In special cases, where a watch is wanted for immediate wear, it will be specially attended to. A moderate fee will be charged, which may be learnt on application to the Editor.

THOMAS WALLEN,
Wholesale Watch Manufacturer,
KING STREET COVENTRY.

Manufacturer of the Machine-made Centre Seconds Stop Watch,

KEYLESS & FULL-PLATE ENGLISH LEVERS.

INVENTOR AND PATENTEE OF A SUPERIOR KEYLESS MOVEMENT IN ALL KINDS FOR THE HOME AND EXPORT TRADE.

The Home and Export Trade supplied with every kind of Watch made by Machinery, at the cheapest rate and on the shortest notice.

THE WATCHMAKER JEWELLER AND SILVERSMITH'S TRADE JOURNAL.

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

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CONTENTS.

	PAGE
Machine Work *versus* Hand Work (A Reply to James U. Poole)	89
Queries and Answers	90
Practical Instructions to Jewellers, Silversmiths and Electro-platers	91
The Construction of a Simple but Mechanically Perfect Watch	92
The Art of the Silversmith	93
Repairing Swiss Watches	94
English Machine-made Railway Watches	94
Hall-Marking	95
On Soldering and Melting	95
The Various Arrangements of the Barrel and Barrel Arbor	96
Lectures on Watch and Clock Making	98
Müller's Patent Chronometer Escapement	100
Lincoln Cathedral Clock	101
Goldsmiths' Company's Prizes	101
On the Fluctuations in the Relative Values of Silver and Gold, with Special Regard to the Present Depreciation of Silver in India	102
A Few Words on Gems and Precious Stones	103
The Jewellery Trade of France and Germany	103
Construction of Timekeepers Delivered to the Board of Longitude, March 7, 1805	104
Bills of Sale	105
Patents	i
Monthly Record of Bankruptcies	ii
Directory	iv
Advertisements	i—xiv

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MACHINE WORK *versus* HAND WORK.

A Reply to Mr. James U. Poole.

No. II.

(*Continued from page* 74.)

MR. POOLE continues his argument, page 41 (October number of this journal):—"The manufacture of watches by machinery can only be carried on on a very large scale." This does not establish his views of the question; on the contrary, it rather establishes what he is endeavouring to deny. Take a parallel case. Suppose you say "there is only one road to Rome," clearly you assert there is such a city, and there is a road that will lead you there; so when you say "the manufacture of watches by machinery can only be carried on on a very large scale," clearly you assert watches can be made by machinery, and the probability of the case from what has been already adduced favour the supposition they can be made to great advantage when made on a large scale. Perhaps without knowing it, and certainly not with the intention, he is writing a flippant advertisement for the American Watch Company, which without doubt is a large factory, and I should have been better pleased to have met with this sentence on one of the fly leaves which cover this journal than on pages professedly scientific. I would not detain the reader by noticing such a fallacious statement as this but for the fact that beneath it lies the whole objection of English watchmakers to machine tools.

If a stock of machine tools could be had for 100 shillings, I am persuaded no watch would be made in this country without them; but because it requires a great organisation and a capital of £100,000, it meets with opposition from small makers. Watch manufacturing, properly speaking, has ceased to be a private or single-handed enterprise.

The system Mr. Poole describes is no doubt very good for making a few odd watches which vary in size and style, and answered well sixty years ago; but it fails to day, not only to produce the work at the market price, even if you lower the workman's wages to starvation fare,—and we have pursued this suicidal policy long enough,—but it fails in quality and quantity also; and it should be observed that the widespread dissatisfaction that is so keenly felt arises not from the fact that we have failed in any efforts that have been made to produce watches on a large scale, but rather from the fact that we have failed to make any effort worthy of the splendid occasion that has been and is still offered to us. That which Mr. Poole thinks a great drawback in machine work is its great virtue.

Mr. Poole then makes a passing allusion to interchangeability, one of the most perplexing subjects in connection with machine tools. He says, "In point of fact the chief feature lies in the movements, which are made strictly to a gauge, thereby enabling the various parts to be interchangeable. A great feature is made of this latter point, but as a practical man I have grave doubts of its real utility." The boasted interchangeability that Americans and I regret to see some English firms advertise, has no foundation in fact. The system of watchmaking by machine tools by which any number of lever escapements can be made interchangeable—even in a subdued sense of the term—is not at present known. Even keyless work, which admits of greater discrepancies than the train and escapement, cannot be made actionable, to say nothing of interchangeable, by the system referred to, but must receive final adjustment by hand; and though it is said to be a "great feature," of which I have found more than enough in their advertisements (it is a loud word that appeals to those who are unsuspecting and apt to believe, but it is dangerous to trifle with a confiding public.) I have searched in vain for it in their work. For example, I find the pivoting various sizes, some extremely light, and others unreasonably heavy; some staff pivots long, some short. The pallet stones and banking pins are made adjustable; in all directions I see marks that are not machine made, and a want of final adjustment bordering on slovenliness. If interchangeability were attainable by such means, its "utility" need not be doubted; for then isochronism, or anything you like to ask for in the watch could be made for 6d. All that can be accomplished is that which I have already stated. The small margin of error admissible in instruments of precision is exceeeded by the cumulative errors imported into the work produced by machine tools. It is true that by great watchfulness the work can in some rare instances be made nearly interchangeable; but there is always an error which is not difficult to detect, nor is is it difficult to correct by the primitive processes of filing, scraping, grinding, polishing, bending, stretching, &c., &c., which give scope and remuneration to the highest order of manipulation, and the most profound knowledge of the theory of watchmaking. The slavery is done away with, and the great bulk of the work is made at a nominal cost. But I must be brief; I see I shall have to refer to this subject again.

Great as are the advantages of machine tools, for which I earnestly contend, there is a limit to their usefulness. Interchangeability is the fatal rock on which all the American companies have foundered; they err in endeavouring to do everything by machine tools. We err in the opposite direction by endeavouring to do everything by hand tools. Truth seldom, perhaps never, resides in the extreme view of any question, but in the middle between the two. Great harm is being done to the subject under discussion by Messrs. Ganney, Perkins, and Company on the one hand, and Messrs. James U. Poole and Company on the other.

The urgent questions that an English watch manufacturer has to ask to-day are these—How far can the work be made with advantage by machinery, and where must skilled hand labour begin? questions that will tax to the uttermost the abilities both of the financier and the mechanic.

An enquiry into the causes that militate against interchangeability would be a very interesting and instructive chapter to watchmakers just now. The counsel Mr. Poole gives on this subject proves that he has given the matter very little attention.

Mr. Poole now quietly turns round and ignores that which he has advanced, and says, "Under any circumstances an amount of skilled hand work is required to supplement the productions of machinery," so it is clear that machinery may be used with advantage notwithstanding his opening statement that *what is gained in rapidity of production is lost in beauty of finish.* The testimony of the tailor also falls to the ground, as it would be absurd to supplement the machine work, that is more expensive than hand work. Where is the large factory spoken of? We must have the machine work before we can supplement it by hand work. What would you think of a brewer who *talked* with you about supplementing the extract of barley with that of hops, and yet discourages the growth of barley, and never lets a sack of it come into his brewery? Would that be an honest brewer? Yet that is just what Mr. Poole is doing in Clerkenwell.

With this altered view of the question, Mr. Poole has found a watchmaker that can stamp it with authority, and you will observe he has had to go to America for one. Next month I hope to write on supplementing machine work by hand work.

RICHARD WHITTAKER.

(*To be continued.*)

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

SIR,—English watchmakers owe a debt of gratitude to Mr. Whittaker for his able article in your January number; we have long desired to see a thorough English skilled mechanic take part in the discussions on "machine-made watches, free from the prejudice, and, we are forced to say, lamentable ignorance, so markedly apparent in the writings, speeches, etc., of Messrs. Poole, Glasgow, etc.

We have rarely read anything emanating from those gentlemen that did not contain something the reverse of fact, witness Mr. Poole's letter in your January number, page 72, wherein he coolly makes this astounding statement, "but taking their (Waltham) watches all through, their competition ought not to be dangerous either in prices, quality, or performance, *and, as at the present time, a very large proportion of the work is executed in this country,* there is no reason why we could not manufacture on the same system."

We have seen something like this before in one of Mr. Poole's letters, and passed it unnoticed, but now that he boldly reproduces a statement so utterly untrue, we challenge him to produce his facts, and give the names and addresses of the makers of any part of the movements which he asserts is "executed in this country," and which we assert are *made* WHOLLY at our factory in Waltham.

Very respectfully yours,
ROBBINS & APPLETON.

Waltham Buildings, Holborn Circus.
7th January, 1881.

QUERIES AND ANSWERS.

Will any reader oblige by giving me an alloy for 18 c. and 15 c. that will produce a good colour when coloured?—A. B.

ARRANGEMENTS have been made to provide Glashütte with standard time once a week direct from the Berlin observatory.

ERRATA.—"Repairing Swiss Watches," No. IV., page 82, second column, line 31, read *centre piece*, instead of *upside down piece.*—"Machine Work *versus* Hand Work," page 74, line 34, the word *wheel* is omitted; it should read *wheel cutting.*

A SELECTION of the designs and models of works to be executed in the precious metals sent to Goldsmiths' Hall, by competitors for the prizes offered by the Goldsmiths' Company in their tenth competition (1880) is now on view at the South Kensington Museum. The Court of the Company have resolved to increase their subscription to the City and Guilds of London Institute, from £2,000 a year to £4,000, the increased subscription to date from January 1, 1881.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. XXII.

(Continued from page 76.)

When the deposit obtained in cold baths is unsatisfactory in appearance, although the quantity is sufficient, the proper shade may be imparted by:—

1. The gilt article is steeped in a solution of nitrate of binoxide of mercury until it has become white. It is heated afterwards to volatilise the mercury, and scratch-brushed.

2. Place the article into concentrated sulphuric acid, then heat it until abundant white fumes are disengaged; throw it, still hot, into a weak pickle of sulphuric acid. In this case the acid has destroyed the organic impurities which may exist in the deposit, and reduces the subsalts of gold to the metallic state.

3. Smear the article with a thick paste of water and powdered borax, or with biphosphate of lime of the consistency of honey, and heat until igneous fusion takes place; then put the article into diluted sulphuric acid, which dissolves the borax or the biphosphate, and leaves the gold with its natural bright lustre.

Hot Electro-Gilding Baths.—As already stated, hot electro-gilding baths are more regular and expeditious in operation, and produce richer tints than can be obtained from cold baths. Their composition also admits of considerable variety, but we limit ourselves to four formulæ, which we employ almost daily, and for the efficacy of which we can answer:—

Crystallised phosphate of soda, 21 ounces;
Bisulphate of soda, 3½ ounces;
Pure cyanide of potassium, ⅓ ounce;
Pure gold, transformed into chloride, ⅓ ounce;
Distilled water, 2⅕ gallons.

This is satisfactory for electro-gilding silver, bronze, and other alloys rich in copper. For gilding wrought and cast iron and steel directly, without a previous coat of copper, the bath is modified as follows:—

Distilled water, 2⅕ gallons;
Phosphate of soda, 17½ ounces;
Bisulphate of soda, 4½ ounces;
Pure cyanide of potassium, ⅙ ounce;
Gold transformed into chloride, ⅓ ounce.

The proportion of gold indicated is that of the metal employed, and it is not necessary to mind the weight of the chloride if the proper amount of gold is dissolved in aqua regia. Ten parts of metallic gold corresponds to about 18 parts of neutral chloride, or to 23 or 22 parts of acid chloride such as is usually sold. Steel articles, after cleansing by alkalies, must be passed rapidly through a very diluted solution of hydrochloric acid, wiped and dipped into a very hot bath with an intense galvanic current at the beginning, which is gradually diminished by partly withdrawing the platinum anode. Small articles of steel, such as pens or watch hands, are threaded on a thin brass wire, and separated one from the other by glass beads. After cleansing, they are put into the boiling bath, rinsed, dried, and polished in hot and dry sawdust. It is preferable to give zinc, tin, lead, antimony, or the alloys of these metals, a previous coat of copper, or to begin the gilding in a hot gold electro-bath, nearly worn out, and to scratch-brush the articles carefully. The gilding is completed in a new hot bath with a strong current.

Preparation of Hot Electro-Gilding Baths by the Preceding Formula:—

1. Put four-fifths of the distilled water into a porcelain dish or an enamelled cast-iron kettle, heated over a charcoal stove, and dissolve in it, by stirring with a glass rod, the crystallized phosphate of soda. When this is entirely dissolved, remove the liquor from the fire, filter if necessary, and allow it to cool off.

2. Place the gold in a glass flask, with—
½ oz. of pure nitric acid,
and 1 oz. of pure hydrochloric acid.
Heat slowly until the gold has dissolved, and then more rapidly to expel the excess of acid. There should remain a thick liquid of a blackish-red colour. Remove the flask from the fire, and by cooling the contents form a brown-red crystalline mass. The cooling is important.

3. Dissolve in a porcelain dish, in half the remaining water, the bisulphite of soda and the cyanide of potassium.

4. Then dissolve the neutral chloride of gold in the remaining water, and pour it slowly, stirring with a glass rod, into the cold solution of phosphate of soda; add the solution of bisulphite and of cyanide. The whole liquor soon becomes colourless; the bath is then ready. If the chloride of gold were thrown into the solution of phosphate of soda while hot, there would be danger of a partial reduction of the gold in the form of a metallic powder. Many gilders substitute ordinary water for distilled water, and dissolve all the salts together, the chloride of gold excepted, which they add to the hot liquor. This method is certainly more expeditious, but the baths are never clean and do not act with certainty.

The hot electro-gilding baths for small quantities of liquor are kept in porcelain dishes, but for large baths use enamelled cast-iron kettles. The temperature may vary from 120° to 175° Fahr. Small articles, such as brooches, bracelets, and jewellery in general, are kept in the right hand with the conducting wire, and plunged and agitated in the bath. The left hand holds the anode of platinum wire, which is steeped more or less in the liquor, according to the surface of the articles to be gilt. Large pieces are suspended to one or more brass rods, and are not moved about. The gilding is very rapid, and sufficient thickness is obtained after a few minutes. The shade of the gold deposit is modified by the amount of the platinum anode dipping into the liquor. If it dips but a little, relatively to the surface of the articles, the gilding is pale; by immersing it more the shade will become deeper and deeper, until it is red. The platinum anode is connected by a conducting wire to the positive pole of the battery, and the conducting wire starting from the negative pole touches or supports the articles to be gilt. As a rule, it is preferable to replace the impoverished baths by fresh ones instead of keeping up their strength by additions of metal, especially for small articles. When gilding large pieces, maintain the strength of the baths by successive additions of chloride of gold, or, what is better, of equal parts of gold ammonium and pure cyanide of potassium. In this manner baths may be made to last a long time, but they are open to the inconvenience of furnishing a red or green gilding if many articles of copper or of silver have been gilt in them.

Articles of copper or its alloys should be perfectly cleansed, and may be passed through a very diluted solution of nitrate of binoxide of mercury. Silver requires to be heated, dipped, and perfectly scratch-brushed. For this metal the gilding should be strong, in order to prevent the corners and raised parts from becoming white and bare; and it is a good precaution to give it a coat of copper or brass, or a first gilding in an old bath.

(To be continued.)

THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.*

BY M. GROSSMANN, Watch Manufacturer,
Glashuette (Saxony).

(Continued from page 78.)

66. I never felt a temptation, however, to apply it to any watch of my own manufacture, as I believe that there is a plainer way of attaining the purpose. First of all it will lead in the direction of having, by observation of the preceding principles concerning barrel and train, a mainspring of comparatively great length and little thickness. In case of breakage, the shock resulting from it will be less injurious, and in winding it the interposing of the stopwork will be more readily felt than with a strong stubborn spring. Secondly, I think it advisable, and practically possible, to strengthen the teeth of the centre pinion and barrel by giving them a shape more appropriate to their functions. Whenever one of these teeth is broken, the fracture invariably takes place at the bottom, where it is thinnest, and has two sharp corners, required by the taste of the great majority of watchmakers. An alteration of this shape would give the teeth about double the strength, as will be evident when looking at the dotted lines marked *a* in the cut, without interfering in any way with the service of the parts. I feel persuaded that the general employment of this form for the teeth of barrels and centre pinions would serve the purpose very well, though it is not pretended that a complete guarantee against fracture would ensue from it; but in this point all the other contrivances are equally doubtful.

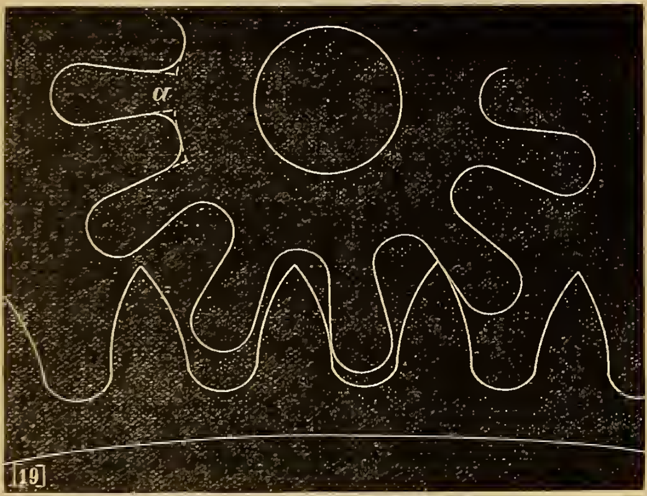

FIG. 22.

CHAPTER VI.

THE MOTION WORK.

67. There is not much to say about the construction of this part of the movement, because it is, to a certain degree, independent of the proportions of the train. In Swiss watches, the motion works are generally much smaller than there is any necessity for making them. With the employment of the free springs, however, there might be some advantage in very small motion works, because the barrel heads of that kind have no shoulders allowing the necessary space for the hour wheel.

68. There are some trifling matters in the motion work open to reform. In English watches, even of the better makers, the minute wheel moves mostly on a brass pin, driven rather carelessly into the pillar plate, an execution altogether unworthy of the character and general workmanship of these watches. The Swiss watches, on the contrary, down to their lowest qualities, have invariably a screwed staff, on which the minute pinion is adjusted. These staffs are not easy to make, inconvenient to take out and screw in again, and by the tapping of the hole in the plate, they offer less reliability of a true pitch than a round hole drilled on the pitch circle. I think there is a way between these two, which is easy of execution, and irreproachable as to solidity and diminished friction. A hole of the same size as that in the minute pinion is drilled through the pillar plate on the pitch circle; a good round and well-polished pin of hard steel, rounded at both ends, is driven into this hole, even with the plate at its inner side, and projecting on the other side till it nearly touches the dial. The minute pinion has a small projecting cannon left beyond the riveting to hold the minute wheel at a little distance over the plate.

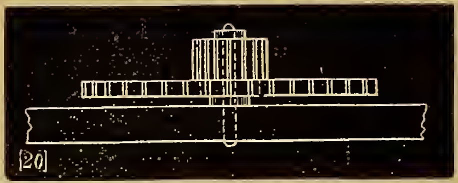

FIG. 23.

69. There is another matter which might easily be improved; it is the way of adjusting the minute hand to the cannon pinion. In almost all Swiss watches the hand is adjusted on the end of the setting staff, and therefore it is necessary to support the setting square when putting the hand on, lest it should come out of its place by the pressure. This is not the case when the hand is adjusted on the extremity of the cannon pinion, which has a shoulder for this adjustment. Besides, this arrangement affords the advantage that the end shake of the hour wheel can be regulated between the face of the cannon pinion and the lower end of the cannon of the minute hand, thus dispensing with the small spring commonly in use for keeping the hour wheel steady in its place.

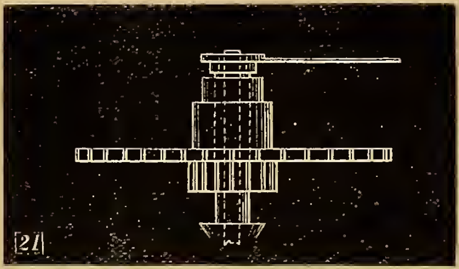

FIG. 24.

70. It remains only to say a few words concerning the setting the hands, which in most cases is done from behind in Swiss watches. The setting the hands on the dial side is an inconvenience almost inseparable from the nature of a full plate movement, but in three-quarter plate and bridge frames there is not the slightest necessity for it. The gradual abandonment of the old plan of cases with fixed domes and the movement accessible only from the dial side brought the reform of the way of setting the hands with it.

(To be continued.)

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SAYS the *Mining Journal*:—The presence of gold in unmistakable quantities in Fortescue (Stannagwyn) Mine, Cornwall, was reported a few days since, the place of discovery being the lode in the engine shaft. A few ounces of lode stuff were only tried for gold, but the result has been so satisfactory that large samples have been sent to London to be tested. It was stated a few weeks ago in Truro that large quantities of gold were found in this mine, and that Sir J. Hawkins made a large sum of money from the sale of gold.

THE ART OF THE SILVERSMITH.

By W. Herbert Singer.

(Continued from page 87.)

BY means of this custom, a considerable number of works in silver were annually scattered over the country. In the manuscripts of Sir Henry Mildmay, the keeper of the jewels for Charles I., is recorded the weight of every present given by the king during his tenure of office. Amongst these same records, there is one dated September 23rd, 1647, which curiously illustrates the mode of living at that time, being the order from the Committee of Revenue to Sir Henry Mildmay, to send the following articles for the king's use, when a prisoner at Hampton-court:— One gilt salt, "Tobias"; 12 gilt trencher plates, crowned E.; two knives; one fork, gilt; two saucers, white; two spoons, gilt. Thus we see at this time even the king had only one fork allowed him, although 12 silver plates were deemed necessary.

The civil war of this period caused great destruction to domestic silver work. The Reformation had swept the Church plate away, and now to supply means with which to carry on the determined struggle in this disastrous war, an enormous quantity of plate used in the household was consigned to the crucible.

We now come to the reign of Queen Anne, sometimes called in England "the Augustine age." Certainly, during her reign, great excellence was reached in this art, whether as regards her coinage, or silver work in general, for all purposes but that of the Church. At this period the chief means of decoration were chasing, fluting, and ribbing, with a large use of the acanthus leaf.

The introduction of tea led to a great development of silversmiths' work. The greater number of the tea-caddies (lately so much sought after) are mostly of this date. Cream jugs, tea-pots, tea-urns and tea-kettles naturally followed the demand for the novelty, and led to a considerable manufacture of new designs.

But, although domestic silver-work made great progress in style, the church plate became more and more debased, and by 1720 the chalice had lost all beauty, and somewhat resembled a large wine glass.

Most of the work of this century was done by men of small means, who had usually two or three workmen only. It was not until quite the end of this period that large factories were formed for the production of silver-work. Amongst the first of these was that of Rundall and Bridge, who employed Flaxman to design for them.

Few industries have had to struggle through more difficulties, restrictions and penalties than that of the silversmith; difficulties beginning so far back that their origin is obscure, but they are much felt in the fifteenth century, still more so in the sixteenth, when it was forbidden to work in a back street. In the seventeenth and eighteenth centuries again more strict, making the crime of forging a die mark to be punishable by hanging, and forbidding any exportation. With such numerous hindrances, it is wondrous how the silversmith's art has flourished at all in this country, and produced such works as it has. If, with all these restrictions, so much has been accomplished, how much more might have been done had the trade been as free as other art industries. Of one thing we may be certain, that whatever preservation or value marks are to plate, the decadence of modern times commenced as soon as a tax was laid on silver-work. This had its beginning in the time of George I., with 6d. an ounce, and went on—with a short interval between 1758 and 1784—increasing up to 1815, since when it has been 1s. 6d., with also a tax on everyone dealing in silver; so that, in fact, there is a double tax.

I will now ask for your patience but a few moments, while I briefly state the present condition of this art. In Germany some very fair work is produced, but chiefly of a heavy character, chased up in the renaissance or classical style. Italy and Spain may be classed together, each being clever in small objects, and the latter country is particularly famous for her damascened productions. France is deserving of high praise for her nineteenth century plate; the figures with which French artists enrich their work being admirably designed and modelled. America is at present making the most rapid advancement in the silversmith's art; from her we have much to learn, if not to fear.

I have spoken of the excellence obtained by the Greek artists, and of the perfection of the silversmith's art in Italy, and also of our own success at the time of Queen Anne, but it is not so easy to speak of our present or future greatness in this art.

There may be many opinions as to the reason of this decadence, but there can be no difference as to a fact, which all must admit, that since the art has been subjected to the trammels of the excise, it has degenerated. In mentioning this, it is not to tie anyone to the opinion that it is through this connection of a tax with labour, but simply to note a concurrence; and if it can be shown that other nations are making progress, and have not this tax to contend with, and that this art has been degenerating in England ever since we have had a tax, the question may then be fairly left for everyone to answer according to the bias of his own mind. I may be permitted to remark that the bias of my own mind is very distinct upon this point. But there are so many conflicting influences, as to make it difficult to get at the real truth of the case. Thus, I know of one silversmith who wished the tax to be twice as much as it is now, and that simply because it may prevent any fresh opponent from having an establishment near him. Now, this man stated exactly the usual protectionist feeling against all rivalry, but the spirit of the age is for open competition, as no art, no profession, nor any industry can ever become general if surrounded with restrictions and difficulties. It so happens that the work of the silversmith—the industry always placed before every other art industry—is the only one now subjected to the control of the tax officer, and to the penalties and endless fines which, in some form or another, harass the worker in the precious metals. That they are serious impediments to art progress is my earnest conviction. We are all acquainted with the liberal professions and the liberal arts, but we hear nothing about the liberal trades. A man is proud to be thought a doctor, a lawyer, a clergyman, or a painter, and why should he not be proud to be an art silversmith? Without doubt the question will soon have to be solved, how we are to rectify this error. The doctor has his medical school and hospital, the clergyman his college, and the painter his academy, in which to ensure a careful training; but where is the silversmith to learn his liberal art?

(To be continued.)

The one Mechanic Buried in Westminster Abbey.—Notwithstanding England's enormous indebtedness to her mechanics, but one mechanical working man has ever been honoured with a burial in Westminster Abbey, and that was Graham, the clockmaker. Graham made exact astronomy possible by his great improvements in timepieces. He invented the dead-beat escapement and the gridiron compensating pendulum, and he was the first to make clocks that would run for many days without winding. Graham was also a maker of great quadrants and instruments of that sort. His funeral was attended by all the members of the Royal Society.—*Scientific American.*

REPAIRING SWISS WATCHES.

No. V.

By H. GANNEY.

(*Continued from page* 82.)

THE difficulties incidental to the stop-work in Swiss watches are often solved by the repairer taking away one of the pieces, by preference the star wheel, leaving the centre pieces to assist in supporting the barrel. In the future, doubtless stop-work in watches will be as rare as in clocks, which even of best foreign make are unprovided with them. The notion that they are necessary is incorrect, as a well hooked main-spring will resist a greater breaking strain than any other part of the watch, and though the pressure on the stop-work transmitted to the barrel teeth and centre pinion is less than that caused by the pull of the main-spring hooked close to the barrel teeth, there is a certain elasticity in the main-spring which about equalises the chance of damage from careless winding. The experience of the Americans is opposed to the stop-work, as, formerly using tho Swiss stop-work to all but their lowest grade of work, when I was working in America, they now dispense with it in all their watches, though making many more varieties and much higher quality of work, in which price or amount of work is of no consequence. This would not perhaps be conclusive as to its value, knowing the preference of Americans for simple methods in their mechanism; but I have had their experience confirmed in a remarkable manner by Mr. Guye, of Clerkenwell, who, adopting the American system of work, has surpassed them in its application to more highly-finished London work; and in interchanging all the parts of his theoretically perfect lever escapement, has left them at present in the rear. Owing to the different lines on which business is conducted in the two countries, it is probable the merits of Mr. Guye's gallant attempt to redeem the prestige and trade of Clerkenwell will remain unknown beyond a select and interested circle, who will maintain a discreet silence, when depreciation is useless. Noticing the absence of stop-work from Mr. Guye's second quality work, I was told they only put it to their best work in deference to general prejudice on the stop-work question; but as a matter of fact the watches kept a better rate without stop-work, as fewer main-springs broke, as the extra width obtained by the suppression of the stop-work gave a strength and elasticity unobtainable otherwise. With such testimony it is useless to contend, and the sooner watch buyers and wearers are enlightened on the subject the better, and with the stop-work will disappear a cause of much trouble to repairers.

Without a stop-work it is necessary that the main-spring be more carefully hooked, as any kind of hook is generally sufficient to retain the spring when a stop-work is used; but when it is absent, care must be taken to use a hook not liable to be cut off by the action of the spring working on it, and care must be used to secure a small and sound hole in the spring, and with not more end left than is requisite to secure a sound hole, or the end will become a lever, and lift the main-spring off the hook.

The usual form of hook is a brass pin undercut, and is objectionable on account of its size and want of strength, and is liable to be forced out as the watch runs down, or to have its undercut hook flattened when winding the spring; in both jobbing and new work we find nothing so good as a simple steel pin with a thread on it made in one of the smallest holes of the screw plate, fitted to a hole drilled in tho barrel at a considerable angle to the centre, and being screwed in tight and broken off from the outside saves filing the gilt barrel, then nipped off inside and filed away to a thickness slightly in excess of that of the main-spring. All extra length only renders it liable to pressure from the coils of the spring when down, besides destroying the capacity of the barrel for holding a long main-spring. A prolific cause of main-springs breaking is the barrel arbor being too small, causing too close a strain on the small coils of the spring. The trouble of putting a larger arbor is sometimes avoided by putting a higher hook, which increases the effective diameter of the arbor; but a better plan of taking off the destructive pressuro on the centre of main-spring, is the insertion of a loose coil of spring between the arbor and main-spring. In a properly proportioned barrel and spring, one-third of the space in the barrel is occupied by the arbor and another third by the main-spring, leaving a third for its working to and from the arbor.

The most effective form of barrel arbor and ratchet is the old form, now disused, for what reason it is difficult to tell, but it seems the law of change governs watch-making even if there is no improvement; the only ratchet and click not liable to failure is that seen in old Swiss watches, with the ratchet held by three screws screwed into the steel barrel arbor, which gives the best possible holding for them, and this part of the arbor also forms the pivot and bearing for the arbor's support to the bar. Its large circumference prevents wear, and the effects of wear do not cause so much motion of the barrel extremities, and the pressure whilst winding is not on the hole and its thin sink, but on the large circumference embraced by the ratchet; its superiority is shown by the fact that watches with this form of ratchet with 50 years' wear are often seen in sounder condition in this part than modern ratchets and barrel arbors with only a few years' wear, and any damage to modern ratchets involves a new entire arbor, the ancient form involving only the replacing the ratchet if damaged in teeth by a new one, which if skilled with the file a jobber could make himself from a piece of round steel fitted tight on the winding square, by opening with a broach; then the screw holes marked or drilled through the holes in the arbor; then re-opened larger to let the winding key through the ratchet; then two fine circles turned for size top and bottom of the teeth and a three square file used to cut the teeth, great accuracy in which is not requisite for effectiveness, as the click will follow any sort of teeth in this arrangement and be effective.

(*To be continued.*)

ENGLISH MACHINE-MADE RAILWAY WATCHES.

WE learn from headquarters and have much pleasure in announcing that the English Watch Company of Birmingham have this year secured the contract for watches for the Indian State Railways, which was last year taken by the American competitors of our home trade. We have in this journal at various times noticed the progress made by the English Watch Company, and their energy and perseveranco in carrying out to a perfect end the system of machine watchmaking in this country, and, considering that they were the first in England to venture the making of watches on the interchangeable system by machinery, there appears a singular fitness that Government work should be entrusted to them. We are promised a sight of one of these watches before long, when we shall afford our readers the opportunity of knowing what the English Watch Company can produce in the way of railway watches.

A legacy of £600 has been left to the Watchmakers' School of Locle.

SEVERAL of the leading Swiss papers are agitating for a patent law. It is high time.

HALL-MARKING.

THE following letter appeared in the January number of the *New York Jewellers' Circular* in answer to the article on hall-marking which we reproduced from our American contemporary in our last issue. The letter bears the signature "L." and is in the words of our authority "from a firm of silversmiths whose artistic works are well known upon both sides of the ocean."

To the Editor of "The Jewellers' Circular."

Your comments (in the December number) in defence of the English hall-marking system, will be read by our silversmiths with more interest than satisfaction. That such sentiments should be uttered by the representative journal of our trade is a matter, to us at least, of profound astonishment. We speak, however, from the standpoints and in the interest of the silversmiths exclusively.

When you intimate that the abandonment of the system in England would result in the flooding of the country with wares unworthy the name of precious metal, we believe the opinion to be an unwarrantable assumption, theoretical rather than practical. In our country, which is happily free from the hindrance, your theory would infer that our leading silversmiths, the honesty of whose productions are unquestioned, are suffering intolerable annoyance by reason of unscrupulous manufacturers. While we admit that the annoyance exists to a very limited extent, it is trifling in comparison with that of being obliged at such a season of the year as this to send every identical article to the Guild to be tested and stamped in their own due time and manner. And should the Guild be located at some city or town distant from the manufactory, the annoyance would indeed be unbearable, and the delay in filling orders well-nigh fatal to the business.

There is, in our opinion, no *reputable* silversmith in the United States that systematically debases the quality of the wares of his manufacture. The leading silversmiths care more for their reputation than for the trifling gain to be obtained by alloying, which is necessarily limited. We say limited for the reason that even a slight deviation from the standard, is readily detected by the workmen, and such a fact known to the employés would be fatal.

In our establishment, the additional precaution is used of employing a refiner, whose duty it is to assay the working stock at frequent intervals; hence, we could, if necessary, safely guarantee our quality to be *above* the sterling standard, and in our long experience as manufacturing silversmiths, have never known a single piece to assay less than the standard. You doubtless have no disposition to question this statement, and with the best of intentions towards us and other silversmiths, advocate the adoption of a system which professes to be for our further and more complete protection. We claim that the English hall-mark is not satisfactory evidence of the quality of the metal. It may be, of the identical spot which bears the stamp, but there are so many ways to overcome it, so many parts which are not and cannot be tested, that if the manufacturer is unscrupulous, he has ample facilities to accomplish his object. Within a very short time it was our privilege to have an opportunity of verifying this statement. A tureen of English manufacture came to us as old silver; it bore the hall-mark; we assayed it in two parts, cutting out the mark and assaying that portion separately. The little piece bearing the mark was up to standard, but the remainder, about 99-100 of the entire article, was considerably below. Now, inasmuch as the purchaser cares more about the article as a whole, than in part, no system can be satisfactory which does not meet his wants in that respect. We also cite a single instance showing the annoyance of the system in another form which recently came to our notice.

A salver was sent by an English silversmith to be hall-marked. In the centre of the piece was an oval section so decorated as to constitute the main feature of the piece. On its return, the hall-mark was so carelessly placed as to disfigure the decoration, and the customer very justly refused to accept it. The Guild was as autocratic as usual, and refused to make good the loss.

Further, the hall-marking in England completely shuts out that market from the American manufacturer, and is an injustice imposed upon no other branch of manufacture, and in our opinion, the comments in the English press, over the signature of Mr. Watherston are not a whit too severe and condemnatory.

ON SOLDERING AND MELTING.

By H. Bush, Hull.

TO *hard solder* gold, silver, or other metal articles which have previously been *soft soldered*, or to melt old gold or silver for re-working, it is absolutely necessary most carefully to remove even the smallest traces of soft solder from the articles, as the heat required for hard soldering would burn the soft solder into the articles and occasion irreparable blemishes, and in melting would make the metal brittle and unworkable.

It is, however, not always an easy task to entirely remove the soft solder by mechanical means such as scraping, filing, or cutting, especially when the solder has run into hollows, interstices, engravings, or chasings, to which places it is very difficult to get at with ordinary tools; in these instances the following manipulation is applied with good results:—

The articles to be cleaned are first heated over the flame of a lamp until the solder begins to fuse, when as much as possible is brushed off with a stiff toothbrush, the heating and brushing to be repeated until no more solder can be removed in this way; the articles are then placed into a heated solution of the following composition, which will dissolve all the remaining solder:—

Two ounces of sulphate of iron (copperas) and one ounce of saltpetre are finely pounded and boiled in a cast-iron vessel in ten ounces of water, until about one-fourth of the solution has evaporated; the vessel is then set aside for cooling, when most of the solution will turn into crystals. After two or three hours the remaining solution not yet crystallised is poured off, boiled again, and set by for cystallising, and the process repeated until all the solution is thus disposed of.

The crystals are then dissolved in muriatic acid in the proportion of one part of crystals to eight parts of acid; of this solution one part is diluted with four parts of water, heated, and the articles to be cleaned immersed therein, when all the solder will dissolve without injuring or discolouring the most delicate piece of work.

Nickel Plating by Boiling.—Dr. R. Kaiser prepares a bath of pure granulated tin tartar and water, which he heats to the boiling point, and adds a small quantity of pure red-hot nickel oxide. A portion of the nickel is soon dissolved, as is shown by the green colour assumed by the liquid which stands upon the grains of tin. If articles of copper or brass are plunged into the bath they become covered in a few minutes with a white, beautiful, silvery metallic coating, which consists almost entirely of pure nickel. If a little carbonate or tartrate of cobalt is added to the bath a bluish shade, either light or dark, may be given to the coating, which becomes very brilliant when it is properly polished with chalk or with dry sawdust.—*Mittheilungen d. Bayr. Gewerb.*

THE VARIOUS ARRANGEMENTS OF THE BARREL AND BARREL ARBOR.

By F. Rosenkranz,[*] in "Grossmann's Watchmaker's Diary for 1881."

READERS of this annual who are acquainted with the general literature of our trade will know that much has been written on the section of the barrel; nevertheless the question is still asked, "How many methods of application or kinds of barrel are there?" nor has this question been satisfactorily answered. Especially are the terms employed for the various modes very vague and indefinite, and whoever will take the trouble to note them will read or hear of plain barrel, going barrel, rotating barrel, fixed barrel, suspended barrel, etc. The same term is often used for two distinct kinds of construction, so that special attention to the connective reading is necessary in order to understand what form is meant by it.

In watches we have almost exclusively to do only with two kinds, viz., barrels with one bar, and those with two bars. Each of these arrangements has its object: the first is applicable for ladies' watches, or watches of inferior quality, and the latter, or those with double bars, for a higher class, and especially keyless watches.

Our notice of the above two kinds is due to a controversy in the *Deutschen Uhrmacher Zeitung*, which was conducted with great energy and shrewdness, but which brought to light very contradictory ideas, though it led to a good mutual understanding. We beg to mention here, that if these articles had been headed by more definite terms than "free," or "fast," or "fixed barrel," an agreement would have been arrived at much sooner. It would have been more to the point to have stated "barrel with one bar," or "with two bars," because these terms were included in the general question, which runs thus: "Which construction of barrel is most serviceable and commendable in watches with horizontal or lever escapements? those with suspended barrels, or those barrels which run between two bars?"

The terms springshaft (Federwelle), barrel arbor, and winding arbor, are not in all cases synonymous, which is clearly seen in fusee watches. These have a barrel arbor, which remains stationary, and a winding arbor, which moves in the process of winding and during the going of the watch. By all barrels with teeth, the barrel arbor forms the winding arbor. According to these observations, we have two cardinal orders of barrels, viz., barrels with teeth, and barrels without teeth. Neither of these is mentioned among the terms we noticed previously.

Further, do we distinguish barrels which are stationary and rotary barrels? The first exclusively in Vienna-Mendal clocks and repeating watches, and the latter by all barrels with or without teeth. The barrel arbor is that part of the barrel which has tho inside eye or end of the mainspring attached to it. This arbor, as we have already observed, does not always serve for the winding of the spring itself, because it is easily seen that a spring can be wound in two different ways, namely, by turning the arbor and leaving the barrel at rest, or turning the latter, and letting the first be stationary (as is the case in fusee watches).

The following divisions and relative diagrams will comprise all forms of construction of the barrel and its arbor. The barrel arbor is taken as the leading object.

I.—The barrel arbor is always stationary (figs. 1 and 2).

II.—The barrel arbor is moved round in winding, but remains fixed as the watch runs down (figs. 3 to 6).

III.—The barrel arbor is movable, both in winding and during the going of the watch (figs. 7 to 10).

By closer examination, it will be found that each article can again be subdivided.

In case I., where the barrel arbor is not movable, there are two kinds of movable barrels, viz., with and without teeth. The last is seen.

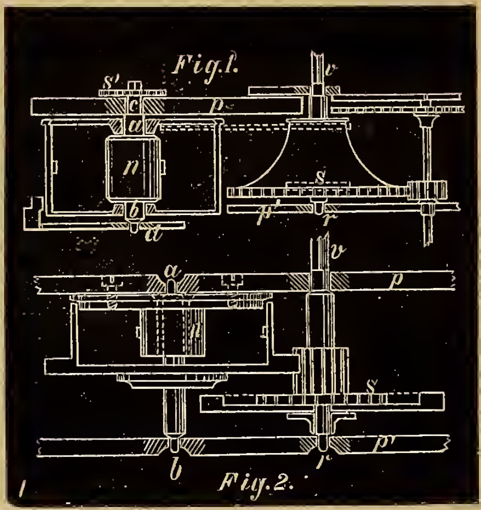
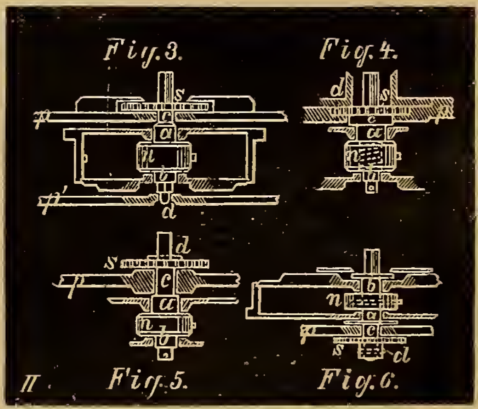


Fig. 1, which represents the great work of a watch, according to the construction of Moritz Grossmann.

The speciality and advantage of this arrangement cannot be discussed here, and hence we refer our readers to the Geneva Prize Essay by M. Grossmann, *Journal of Watchmaking*, 1880 (Nos. 24, 25).

We may mention, in passing, that the third wheel runs in a recess turned in the top plate, and that the barrel, which is of considerable height, runs in a counter bar, which lays close to the dial.

A remarkable construction of barrel with teeth, which does not often come to the notice of watchmakers, is shown in fig. 2. It is employed in electric lamps for the motion of the carbon points. Instead of a fusee and chain, there is here a wheel and pinion. The hollow barrel arbor, *n*, is, together with a brass disc, which serves as barrel cover, screwed to the plate. The barrel, which on all other occasions rotates about the pivots of the barrel arbor, has here pivots which have their corresponding bearings in the plates. The winding square, *b*, and the ratchet, *s*, have the same action as that of the fusee (fig. 1).



In case II., where the barrel arbor only turns in winding, but remains at rest during the going of the watch, we have two leading modes of construction of toothed rotating barrels, viz., as already observed, barrel with one bar (fig. 4), and with double bar (fig. 3).

In the one with the single bar (fig. 4), the barrel arbor and ratchet form one piece, but in fig. 3 the ratchet is fitted to the arbor. A solid ratchet and arbor is not an absolute requirement in barrels with single bars, as will be seen by a reference to figs. 5 and 6. Fig. 5, which is an unusual construction, has a barrel arbor, as in fig. 3, but with this difference, that the pivot, *c*, which goes through the bar, is much longer, and therefore has more "guide" to protect it against side shake.

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[*] The able editor of the *Allgem. Journals der Uhrmacherkunst.*

The ratchet wheel, *s*, is fitted on to the square end of the arbor, and held firm by a pin, *d*.

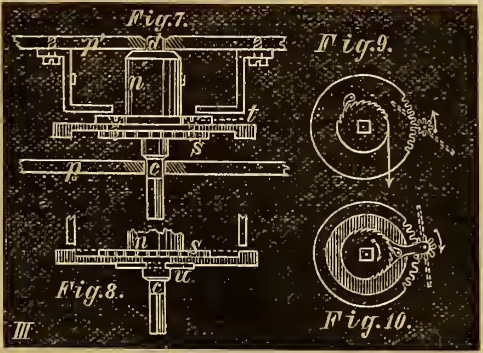
The arrangement as shown in fig. 6 is found only in old flat horizontal watches, where the third wheel as well as the barrel teeth are close to the plate.

The barrel arbor has no bar in this case, because it is pivoted into the plate. On one side there is a shoulder, and on the other a ratchet, *s*, with a round hole and pipe, through which the pin, *d*, is inserted. This mode affords little stability, the pivot, *c*, being so very short; and moreover it is possible that if the barrel cover should through any occurrence get loose it may fall out when the watch case is opened.

Case III.—When the barrel arbor moves both in winding and unwinding of the spring the barrel becomes part of the plate. In American clocks it is even entirely dispensed with, and only a few pins put to prevent the spring from spreading too far, and the outer end is attached to one of the pillars. In this, as well as in case II., the barrel arbor serves as a winder of the mainspring, just as in all clocks driven by weight the axle of the drum serves for winding.

In practice, two kinds of this class are met with, viz., one in the Vienna-Mendal clocks (Stutzuhren), fig. 8, and, second, in the striking motion of repeating watches, both of old and modern construction. Fig. 7 represents one of the older construction, where the ratchet, *s*, is attached on the side next the plate, whereas in the Vienna clock the ratchet is next the spring. In each instance the ratchet wheel, *s*, is mounted firm on the arbor, *n*. In fig. 7 both are made of one piece. The disc, *t*, with its twelve teeth for lifting the hammer, keeps the ratchet in its position. In fig. 8 it is kept in its position by a slide, *u*.

In the second division it is evident that only barrels with teeth can be used, and on a superficial examination it may appear that in the third division barrels without teeth can be used only. But this is not the case; and though a toothed fixed barrel is not at all, or very seldom, employed in our trade (as perhaps in elliptical trains or in tourbillons), it has some attraction as an exceptional kind of mechanism. To make a comparison with fig. 10 as easy as possible, fig. 9 represents the great wheel of a Vienna-Mendal clock, which for the sake of simplicity is made to act direct into the fly. In fig. 10 we have the projecting rim of the barrel cut, and forming a wheel of the same diameter as in fig. 9. The shaded part represents the inside of the barrel, the mainspring of which acts from left to right, as in fig. 9. The direction of winding is, of course, from right to left. The click, which in fig. 9 is attached to the great wheel, has here a place on a special arm, which is mounted in the place of the great wheel. Into the end of this arm the fly pinion is pivoted, whereas in fig. 9 it is run in the plates.



The lever arm, with the pinion, moves about the fixed wheel in the same direction as the great wheel, fig. 9, but the pinion in the opposite direction as that in fig. 9.

Though this arrangement appears very simple, it is not without its objections. Apart from the fact that the oil from the mainspring can run over the plate, it has the disadvantage that the power is taken off the train during winding, which is thus forced backwards. The evil consequence of this can only be prevented by a maintaining power, as in regulators. In fusee watches we have the same loss of power during winding, hence the best English watches are supplied with maintaining power.* The toothed barrel, fig. 3, has the advantage of great simplicity without these objectionable characteristics, and therefore its general application.

After we have thus briefly considered the various modes of construction in their several connections, we would solicit the reader to take a closer view of the elements of the movable arbors, their pivots and corresponding bearings; the diagrams delineating the positions of the pivots will assist him in this; those of the barrel have a different direction than the ones in the plate.

The great work of the fusee watch, fig. 4, has six pivots, besides bearings; two on the fusee, four on the barrel arbor; of the latter, only *c* and *d* are used in the setting up of the mainspring. In fig. 2 are four bearings or holes, besides pivots, two to the barrel, and two to the winding arbor. In watches with barrels carrying teeth, in contrast to fusee watches, less pivots are needed. In fig. 3, the barrel with double bar, we have four pivots; figs. 4 to 6, in the barrel with single bar, we have only three. In all figures the pivots of the barrel are marked with *a* and *b*, and those running in the plate, *c* and *d*. As in figs. 4 to 6 the lower pivot, *d*, is missing, we have assigned the same letter to the part which is in the place of it. In fig. 4 it signifies the small cap, with three or four screws. In figs. 5 and 6 it is the pin which keeps the ratchet wheel in its place. And, lastly, in figs. 7 to 10, as in the Mendal clocks and repeating watches, we have only two pivots and two bearings.

The barrel in figs. 1, 3, 4 and 5 of a fusee watch, and the barrel with single and double bar, rotates about its bearings and the fixed pivots. The reverse is true in fig. 2; and in figs. 7 to 10 the barrel has no pivots at all.

The above considerations could be easily extended if it were not that our space is very limited, and since we are now in possession of a trade organ, this can be used for the object of more extended views and opinions in this matter.

Forging the Hall-marks.—Walter Roberts, aged 40, engraver, 35, Charles Street, Islington, was charged at the Clerkenwell Police Court on the 26th ult., with counterfeiting and uttering the marks of certain dies used by the Company of Goldsmiths for marking wares of gold. Mr. W. S. Prideaux, clerk of the Company, prosecuted. The case arose out of that of William Cantell, of 7, St. John's Lane, who on Monday was committed for trial on a charge of forging the mark of the company on rings, watches and chains. Detective-inspector Peel and Detective-serjeant Thomas Greet on Saturday proceeded to the prisoner's house with a search warrant. Roberts said he had no dies or stamps for copying the marks, but seven punches, imitations of the Goldsmiths' dies, were found in the drawer of a box in which the prisoner kept his tools. A silver watch was also found, having the Goldsmiths' mark on it. The prisoner was committed for trial at the Central Criminal Court.

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* There is a kind of American watch made, otherwise well constructed, which, strange to say, has such a barrel arrangement, and the above-mentioned maintaining power.

LECTURES ON WATCH AND CLOCK MAKING,

PREPARATORY FOR THE ELEMENTARY EXAMINATION OF THE CITY AND GUILDS OF LONDON INSTITUTE IN MAY, 1881.

DELIVERED AT ST. THOMAS CHARTERHOUSE SCHOOL BY I. HERRMANN, ON MONDAY EVENINGS FROM OCTOBER 25TH.*

(*Continued from page* 81.)

WHEEL AND AXLE.

SO far we have taken the conditions of a great work in the terms of lever. If we now consider the chain and great wheel radii as so many consecutive levers till they form continuous curves and a circle, we have the application of a wheel and axle.

There is also one other fact we must notice. Hitherto we have neglected the bulk of the line in a clock, and of a chain in a watch. Practically, the line becomes part and parcel of the drum or fusee, and thus when we speak of or state the magnitude of the radius, that will be less by half the thickness of the chain or line, or the diameter which is less by the measure of the thickness of the line or breadth of the chain.

Thus the proportion for a clock drum is—

W : P : : radius of great wheel : radius of drum + $\frac{1}{2}$ line.

LENGTH OF LINE IN RELATION TO RADII OF DRUMS.

The relation of the fall available to the period of the going of a clock is of sufficient importance that we should notice it.

The ratio of diameter to the circumference of a circle is = 3·1416; that is, if the diameter is multiplied by this quantity, we get the magnitude of the circumference. If we wish to know the length of a line that is required to go once round a drum, we have to add the thickness of the line to the diameter of the drum.

Example.

Let the diameter of a drum = 10, the thickness of the line = ·5; required the length of line to go once round the drum.

Thus:—Length = (10 + ·5) × 3·1416
= 10·5 × 3·1416
= 32·9868

Application.

In a turret clock we have a fall of 15 feet, thickness of line = ·25 inch, and require 10 turns or rotations of the drum for the time of going of the clock; what is the diameter of the drum?

Answer—15 feet = 15 × 12 = 180 inches.

The line available for one turn of the drum = $\frac{180}{10}$ = 18 in. This will represent the measure of the circumference drawn through the centre of the line. Then the diameter of this circumference = $\frac{18}{3\cdot1416}$ = 5·729. Deducting from this the measure of the line, we have the diameter of the drum = 5·729 — ·25 = 5·479.

By the same process we can determine the length of chain, diameter of barrels, etc., in great works of watches.

WATCH BARRELS AND MAINSPRING.

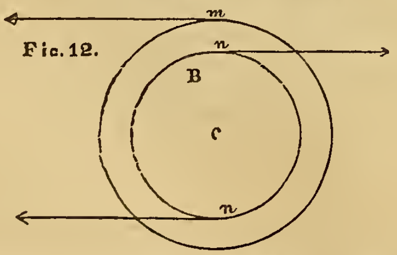


FIG. 12.

Let B, fig. 12, represent the barrel of a watch or chronometer, and let *m* represent the circle drawn through the central point of the breadth of the chain, or pitch circle of going barrel, and *n* the point of application of the mainspring. Let this point lay in a line drawn from the centre of barrel *c* to the point where the chain departs from the circumference of the barrel, and let the mainspring act in a direction at right angles to this line, then we have clearly again the conditions of a lever of the second order, to which the pressure on the barrel arbor is proportioned; this position gives the minimum pressure.

But with every degree of rotation the condition of this pressure changes. Thus when the point of application of the mainspring has made half rotation, and is on the other side of the centre of motion or *n*, we have the condition of a lever of the first order, and therefore the pressure will be the maximum. As we know that in all levers there is the least difference of power and weight when there is the least difference in the length of the lever arms, it is evident that the nearer the point of application of the main spring is to the chain or pitch circle of a going barrel, the more we economise the force of the spring.*

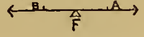
Some discussions have taken place at different times as to the possibility of equalising the force of the main spring. We shall analyse some arrangements for this object, but will require first to make ourselves acquainted with the principle of the parallelogram of forces.

THE PARALLELOGRAM OF FORCES.

In our studies of the principle of the lever as applied in great works of clocks and watches, we have assumed and confined ourselves to those conditions where the weight and direction of the power act at right angles, or perpendicular to the lever arms, and have elicited the results of the moments of the weight and power into their respective lever arms, and the pressure on the fulcrum. The idea we have thus far attached to the term "pressure" satisfies the conditions of the application in the section under discussion, but it does not apply where the forces are acting on a lever at any other than a right angle.

When the weight or power is applied at an oblique angle, a new principle is introduced, affecting the conditions of both, the moments and pressure.

It will somewhat assist us to get hold of the idea, if in the way of introduction we treat first what we have termed pressure in another mode. If in the place of the fulcrum of a lever of the first order, we apply a force equal in magnitude to the pressure, and in the same direction, we shall not disturb the conditions of equilibrium. This force, which is equal to the power plus the weight, and parallel to both, we call the resultant of parallel forces. Thus in a lever of the second order the weight will represent the resultant of the power plus pressure on fulcrum; and in a lever of the third order the power that of the weight plus the pressure.

FIG. 13


Again, let A B, fig. 13, represent a lever, movable about F, and two forces, P and Q, applied at A and B, and in the direction of F A and F B respectively; then if P and Q are equal the pressure on F, or the resultant of P and Q will = 0. Since then it follows that, if two forces act parallel, the resultant is equal to their sum, and if in opposite directions in a straight line, it is equal to their difference, the resultant of any two forces acting at some angle in their direction, must be greater than their difference and less than their sum.

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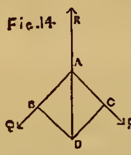
* All rights reserved.

* The terms, Power and Weight, as we have used them here, and as they are used by the trade, are somewhat confusing. Hence it is necessary to notice that W, or Weight, represents the source of force, and Power its effect, as on *m n*, Fig. 12, or on the centre pinion in the other examples.



Let Q, fig. 14, represent a force acting on a point A, and let A B equal as many linear units as there are units in Q. Also let P represent a force acting on A in the direction AC, and let A C equal as many units as there are units in P.

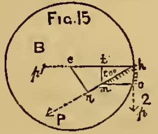
Draw a line from B parallel to A C, and also from C parallel to A B, meeting the former in D, and join A D. The figure A B D C is a parallelogram, and A D its diagonal, and in its application is called the parallelogram of forces.

The diagonal, A D, will represent in magnitude and direction the resultant of P and Q; and a force, R, applied at A in the direction of D A, and of as many units of force as there are linear units in A D, will keep P and Q in equilibrium. This principle is generally stated thus:—"If two forces acting on a point* are represented in magnitude and direction by the sides of a parallelogram, the diagonal will represent their resultant in magnitude and direction."

The parallelogram of forces admits of a twofold application. We can use one force for two or more, and inversely use several forces to do the work of one. If two or more forces are substituted by one it is termed "composition of forces," and when one force is substituted by two or more, "Resolution of forces."

Application to Main Springs.

In fig. 12 we restricted ourselves to the conditions of the direction of the pull of the spring being at right angles to the radius of the barrel hook. This condition, however, represents the action of the mainspring only during a small interval of the time occupied in its development; this angle gradually decreases, and forms a minimum when the spring is wound up.



Let B, fig. 15, represent a barrel; C the centre, h the barrel hook, P the pull, or force of the string, and $h\ r$ its direction. Let the angle formed by the radius of the barrel drawn to the hook h, and the direction of the spring $r\ h = c\ h\ r =$ 30 deg., and let the force of the spring = 10 units. We have here then the principle of a lever arm, with the force acting oblique, and the question is, what is the moment of P into the lever arm $h\ c$?

A little reflection will make it evident that P is resolved into two forces, one acting parallel to $h\ c$, and another at right angles to it. If we for a moment consider the force P to be acting parallel to and in the direction of $h\ c$, it would be entirely used as pressure on the fulcrum, and no motion of h about c could result. Again, (as shown in fig. 12), the greatest moment is obtained when P is perpendicular to $h\ c$, in which case the pressure on c in the direction of $c\ h$ or $h\ c$ is = 0. Therefore in proportion as we have P acting at an angle that is less than a right angle, have we part of P expended in pressure on c in the direction of $h\ c$, which therefore is lost, and the force available to turn h about c is represented by p^2.

We will adopt the graphic mode of solving this problem.* hp^1 and hp^2 represent the directions of the forces P is resolved into. Make $m\ h$ equal 10 units, and draw $m\ o$ and $m\ t$ perpendicular to $h\ p^2$ and $h\ c$ respectively. Then according to the rule established, $h\ t$ represents that part of P which is exerted in the direction of $h\ c$, and $h\ o$ that part which acts at right angles to it. Set off units on $h\ t$ and $h\ o$ equal to any one of the divisions of $m\ h$; then the number of units in $h\ o$ will represent the units in the force p^2, and the number of unites on $h\ t$, that of p^1. The force p^1 is lost in pressure on c, therefore the moment of

$$\text{P} \times h\ c = p^2 \times h\ c$$

Again draw $c\ r$ perpendicular to the direction of the force P; then angle $c\ h\ r = h\ m\ o$
and $h\ o : m\ k :: r\ c : h\ c$
that is

$$\frac{p^2}{\text{P}} = \frac{c\ r}{c\ h}$$

$c\ r$ is called the virtual lever arm, which is always represented by the perpendicular drawn from the fulcrum to the line of direction of the force. Thus—

$$\text{P} \times r\ c = p^2 \times c\ h$$

For an ∠† of 30° $h\ o$ will be $\frac{1}{2}$ of $m\ h$, and ∴‡ $c\ r = \frac{1}{2}\ c\ h$ §. Then if $m\ h$ represents 10 units, $o\ h = 5$. Again, let $c\ h$ equal 16 units, then $c\ r = 8$. Hence we have $p^2 = \frac{1}{2}\ \text{P} = 5$, and the virtual lever drawn $c\ r = \frac{1}{2}\ c\ h = 8$, and $5 \times 16 = 10 \times 8$, that is the moments of p^2 into $c\ h$, and of P into $r\ c$ are equal.§

(*To be continued.*)

RECENT Government statistics state that the Royal Pawn Offices of Berlin had no less than 19,635 watches, and 67,612 gold and silver articles in their possession on the 17th of January, 1880. The average amount lent on the watches was 20s. 3d., and on the gold and silver articles 26s. 5d.

VALUABLE AND APPROPRIATE PRESENTATION.—On the occasion of the turning of the first sod in connection with the Hull and Barnsley Railway and Dock, Lieutenant-Colonel Smith was presented with a spade and barrow, which for beauty of design and richness of mounting have never been surpassed, if equalled. The spade is, apart from its intrinsic value, a real work of art, and the implement which played such an important part in the interesting ceremony, together with the barrow, has been specially designed and executed, on the order of the contractors, Messrs. Lucas and Aird, through Mr. B. Barnett, silversmith, of Whitefriargate, Hull, by Messrs. Garrard, of London. The handle of the spade is of solid silver, engraved with Colonel Smith's crest and motto. The shaft is of the finest solid ivory, and the socket and blade are of silver. The blade bears the following inscription:—"In commemoration of turning the first sod of the Hull, Barnsley, and West Riding Junction Railway and Dock, by Lieut-Col. Gerard Smith, J.P., 15th January, 1881." The barrow is made of polished oak, with massive silver mountings. The wheel is of solid silver of great weight. Inside the barrow is a silver shield with the inscription, "In commemoration of turning the first sod of the Hull, Barnsley, and West Riding Junction Railway and Dock, by Lieut.-Col. Gerard Smith, J.P., 15th January, 1881." The spade is of the ordinary length, but is, by reason of the great quantity of silver, very heavy, as is the barrow for the same reason.

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* By a point is meant here a body that is so small that its relative parts need not be considered.

* It can be more accurately done by trigonometry, but it will not be possible to avail ourselves of this method in the elementary course.

† ∠ is the sign of abbreviation for "angle."

‡ ∴ is the sign of abbreviation for "therefore."

§ for an ∠ of 45° with $c\ h = 1$, $c\ r = \sqrt{\frac{1}{2}}$ for ∠ 60 = $\sqrt{1 - \frac{1}{2}^2}$

MÜLLER'S PATENT CHRONOMETER ESCAPEMENT.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

DEAR SIR,—When I announced, in the November issue of your Journal, my intention to submit a marine chronometer provided with the escapement, invented and patented by me, to the next Greenwich trials, I was not aware that the last day for the deposit of chronometers at the Royal Observatory for the forthcoming annual trial was *at so early a date* as January 10th, 1881, and being only now engaged in the construction of marine chronometers I am reluctantly compelled to defer the fulfilment of my promise for the next occasion.

In the meantime I have the satisfaction to lay before you authenticated copies of opinions received of eminent horologists in Switzerland and Germany to whom I have submitted perfect going models of my escapement for inspection and trial:—

ALBERT JOHANN, Watch Manufacturer, AARAU, Switzerland, author of *Allgemeines Lehrbuch der Uhrmacherkunst*, and inventor and patentee of an improved system for *Hydro-Pneumatic Clocks*, says :—

"Although I have only superficially inspected the mechanism of the going model of your escapement, I am confident that the setting in motion can be effected in the easiest possible manner, in consideration of its having a minimum of friction, and find the impulsion of the *second* balance spring, on account of its elasticity, which forms the constant force, very active; two advantages I consider of great importance.

"Ingenious is the contrivance of the mechanism imparting the locking and releasing of the escape wheel in such a manner as to produce isochronism."

HUGENTOBLER, Watch Manufacturer in WEINFELDEN, Switzerland, and editor of the *Schweizerische Uhrmacher Zeitung* :—

"Should it be possible to modify the movement in such a manner as to make it available for pocket watches, it would offer prospects of great utility, could be brought into common use, and would undoubtedly be preferred to watches with the lever escapement."

WATCHMAKERS' ASSOCIATION IN BERLIN.

At a meeting of this Association recently held, the following unamimous resolution followed a discussion on this escapement:—"This meeting is of opinion that the escapement invented by Herr Müller offers very notable advantages in consideration of the constant force by which the impulse is effected and the close timekeeping obtained."

GRAF-LINK, Watch Manufacturer in ROMANSHORN, Switzerland :—

"I have tried the going model you sent, and am fully confident that the escapement will answer admirably for timekeepers of larger dimensions, and will secure the purpose designed, viz., *correct timekeeping*. If it could be made available for portable timekeepers and supersede the escapements *à bascule* (pivoted detent), or *à ressort* (spring detent), neither of which, nor the duplex escapement, are reliable for pocket watches exposed to jerking or shaking in riding, etc., a very important advantage would be obtained, finding that the action of your escapement cannot be brought to *stop* in any position and under any reasonable circumstances. In response to your suggestion I will try to construct watches in the manner you describe, and as I take great interest in your valuable invention, which, if well executed, will realise excellent results, I have resolved to start at it at once, and you may please send me the articles you mention."

G. TH. VÖLLING, JUN., Chronometer and Watch Manufacturer, ROSTOCK, Mecklenburg Schwerin, holder of the silver medal awarded for superior finish of chronometers by the jury of the Industrial Exhibition held at Schwerin in 1861 :—

"In returning the model of the escapement you sent for my inspection, I avail myself of shortly expressing my opinions thereon. The invention has the following advantages: It enables the balance to unlock the escapement in a remarkably easy manner, requiring a minimum of power. The impulse is not imparted to the balance by the scape-wheel as in the ordinary chronometer escapement, but by an isolated impulsator, which is influenced by the scape-wheel, whilst the balance in the first vibration unlocks the scape-wheel, it (the scape-wheel) winds the impulsator to give in the immediately following opposite vibration, the impulse, and as the balance only requires a very slight force for the release of the scape-wheel, the impulsator in consequence needs only weak impulsions to keep the balance moving, and the advantages arising therefrom are :—

"*a.* Application of a weak motive power, consequently diminution of friction on the pivots and teeth.

"*b.* Increased durability of movement.

"*c.* Independence of the variations of the motive power, main-spring, or irregularities in the train by not affecting the impulsions, which are invariably alike. The fusee can thus be dispensed with in marine chronometers, and the isochronous balance spring in marine as well as pocket chronometers.

"In consequence of the slight power required for the release of the escape-wheel, the lighter balances are admissible; these in return are contented with weaker balance-springs, and require less powerful impulses to effect the desired vibration and produce a proportional decrease of friction on the pivots, &c.

"I am fully convinced that this invention has opened the path to important progress in the higher branches of horology, and would be pleased to find abler men directing their attention to investigate and report upon it."

If you can grant me space for the above in your widely circulated Journal, I shall deem it a great favour.

Respectfully yours,
AUG. E. MÜLLER.

Vienna, Austria, *January 2nd*, 1880.

LIVERPOOL CATHEDRAL PLATE.—On the formation of the new diocese of Liverpool, a number of valuable gifts were offered to the Bishopric Committee for their acceptance on behalf of this new See. Among these were a superb service of altar plate, consisting of two flagons, four chalices, four patens, and four plates, the munificent gift of a lady, Mrs. Lawrence; and to these were added, by Messrs. Elkington and Co., the offer of a magnificent alms dish. The designs for the entire service have now been completed by Messrs. Elkington and Co., with the assistance of eminent authorities in ecclesiastical art, and are of themselves beautiful art productions. They have been inspected by the Bishop and others interested in the See, and have called forth unqualified admiration. The general style is the foliated Gothic, and Christian symbolism has been freely used in the ornamentation. Thus the graceful forms of the vine, the passion flower, and the lily are entwined with the cross and the heavenly crown, whilst the pourtrayal of the prophets of the Old and the Apostles of the New Testament unites the old and new dispensations. The eight principal events in the life of Our Lord are recorded in the alms dish in repoussé work, which will be the principal process employed throughout the manufacture. The service will be constructed in solid silver, richly gilt, and studded with jewels and enamel, and is intended to be completed in the ensuing autumn.—*Morning Post.*

LINCOLN CATHEDRAL CLOCK.

THE Lincoln Cathedral has been provided with a new clock by Messrs. W. Potts and Sons, of Guildford Street, Leeds.

The old clock, which it has superseded, was originally placed in the North-west tower of the cathedral in 1775. It was removed to the broad tower in 1835. The maker's name upon it is that of "Thwaites, London, 1775"; and "Justin Vulliamy and Son" appear to have made some alterations and additions at a later period, the date of which is not given. Its escapement is on the old-fashioned "recoil" principle, which has long ago been abandoned for all clocks which have any pretension to great accuracy; and, as a matter of course, its whole construction contained none of those improvements by which, during the last thirty years, the science of clockmaking has been so remarkably distinguished. Its time-keeping powers were probably never of a very high order, and of late years its vagaries have been such as to cause at times considerable public inconvenience; in fact it was only by the constant attention of those to whose care it was entrusted that it has been kept to time at all. After receiving a very unfavourable report upon its condition, the Dean and Chapter very wisely, and with most praiseworthy liberality, determined to replace it by an entirely new clock.

The new clock has Sir E. Beckett's double three-legged gravity escapement, weighs about 4 tons, and strikes the Cambridge quarters. The weights by which the clock is driven weigh altogether about 30 cwt., and are suspended by ropes, each about 270 feet in length, made of the very best steel wire. These are carried to the top of the bell-chamber over strong wrought-iron block pulleys, bushed with brass, and they descend the tower to a depth of about 90 feet. The barrels on which these cords are wound are of iron. The large going wheel is 15 inches in diameter, and has maintaining power attached for keeping the clock going during the time of winding, on the improved bolt and shutter principle, as devised by Sir Edmund Beckett; which is so contrived that the man employed to wind cannot commence operations without putting this apparatus into action; and when the process of winding is completed, the key cannot be removed without throwing the maintaining power out of gear.

The pendulum beats 1½ seconds, which implies a length of about 7 feet 4 inches. The cylindrical bob is of cast iron and weighs 2 cwt. There is a degree plate fixed under it for observing the arc described by the pendulum; also an arrangement for increasing or diminishing this arc at pleasure. In addition to the usual inside dial of turret clocks showing the hours and minutes, there is another showing the seconds, which will enable the rate of the clock to be observed accurately. It would be impossible to attach external dials without seriously marring the appearance of the noble tower. This causes the striking arrangements to be of the first importance, and every care has been exercised to make them as perfect as possible. Strict accuracy in the striking of large clocks cannot be secured without special apparatus. Even in the best of them the time indicated by the first blow of the hammer will differ by several seconds, on either side, from the time actually kept by the clock. It is probable that until the completion of the Westminster clock—one of the conditions in the contract for which was that the first blow of the hour should always be struck within a second of the real time—there was no public clock in the kingdom that could be depended on to strike with unvarying accuracy. In order to comply with this condition, Sir Edmund Beckett contrived a plan for the Westminster clock, which, with certain modifications, and in an improved and simplified form, is employed in that of the Cathedral. But whilst in the case of the Westminster clock this contrivance is applied to the hours only, in the Cathedral clock it is attached to the quarters also; and we believe that for exactness in this important point of discharging the striking, this clock is unsurpassed by any yet made. The large main wheels of the hour and quarter trains are 22 inches in diameter. The hour wheel has ten steel cams attached, and lifts a hammer of 224 lbs. weight, which strikes the hours upon Great Tom. This fine bell, which was founded by Mears in 1835, is 6 feet 10 inches in diameter, weighs 5 tons 8 cwt., and is 6 inches thick. Its clapper weighs 150 lbs., and the weight of the hammer belonging to the old clock was 140 lbs. The hammer falls through a distance of 8 in. It is mounted on a strong wrought-iron shaft, which is fixed in a cast-iron frame, fitted with the usual steel check-springs to avoid jarring the bell: these springs can be adjusted to the required height by means of screws. The situation of the clock being about 30 feet below the bell-chamber, the hammers are connected by steel wire cords, with elbow cranks, and screw-links for regulation. In the striking part is also fixed a frame containing a spiral buffer-spring for the levers to drop upon, so as to prevent any jar from the falling of the heavy hammers being conveyed to the clock train. Both the hour and the quarter striking movements have what are termed locking plates, which are much to be preferred, for turret clocks, to the racks which were formerly used, being more certain, uniform, and regular in their action. There are two large flys for regulating the speed of the striking, with ratchets and steel springs, which can be adjusted to make the clock strike either quicker or slower. The quarters are struck by an entirely separate train of wheelwork from that which strikes the hours. Its hammers are fixed on the same principle as that of the hour train. Its main wheel has five sets of cams, with the necessary levers for lifting the five hammers which are required to strike the correct Cambridge quarters. The whole of the arbors of the wheels throughout the clock are of steel, and all the bushes are of gun-metal or the best hard brass, and are screwed into the frame, so that each or any wheel can be taken out separately, if required, without disturbing the remainder.

The striking trains require winding daily, and the process occupies about 20 minutes for each; the going train is wound once a week, in about the same time.

GOLDSMITHS' COMPANY'S PRIZES.

THIS Company have awarded the prizes offered for designs and models of articles executed in the precious metals, workmanship being taken into consideration in making the awards. The following competitors have received prizes:—H. Barrett, Campbell Cottage, Mottingham, Kent, £50; J. W. Bradburn, Coalbrookdale, Shropshire, £40; H. Stannus, 118, Kennington Park Road, £30, £20, £10; W. H. Singer, Frome, Somerset, £20, £10; R. Needham, 200, Albert Road, Heeley, Sheffield, £20; M. Hayes, 10, Guthrie Street, Chelsea, £20; F. Marriott, 2, Phene Street, Chelsea, £20; W. Allen, 17, Stangate Street, Palace Road, Lambeth, £20; J. R. Duffield, Oxford Place, 68, Ryland Road, Birmingham, £15 and £10; E. Brown, 17, Farringdon Road, £15; J. J. Shaw, 21, Townsend Road, Stamford Hill, £10, W. R. Corke, 61, St. Peter's Street, Islington, £10: J. A. Sherlock, 7, Halsey Road, Chelsea, £10; E. Beresford, 15, Myddleton Place, St. John's Road, £10; J. Hedgate, 19, Walton Street, Chelsea, £10; F. Gibbons, 19, Thomas Street, Cirencester, £10.

Silver Plating.—In plating German Silver, H. Krupp, of Vienna, first deposits a galvanic coating of nickel, next a coating of copper, and finally a coating of silver.—*Dingler's Journal.*

ON THE FLUCTUATIONS IN THE RELATIVE VALUES OF SILVER AND GOLD, WITH SPECIAL REGARD TO THE PRESENT DEPRECIATION OF SILVER IN INDIA.*

By Edward J. Watherston.

(*Continued from page* 65.)

Above all, if the public are to be protected by compulsory legislation, they ought surely to be so in regard to articles of public importance. Many a railway accident is caused by defective rails and girders, and these therefore ought surely to be "hall-marked," even before silver teapots or cruet-stands. But the whole thing is an absurdity from beginning to end, as pointed out very clearly by Mr. T. H. Farrar, the permanent secretary of the Board of Trade, as well as by others, before a Select Committee of the House of Commons on hall-marking, which sat in 1878-79, and unanimously condemned the taxation of silver. But it is doubtful whether, unless great public pressure be brought to bear upon Parliament, the old oppressive hall-marking legislation, which not only cripples a whole trade, but creates vast mischief in the depreciation of the value of silver, will soon be repealed. It is a legislation connected in more than one sense with that of 1816, which "demonetised" silver, *i.e.* depreciates it in value. The simple question therefore arises, "Is it wise to depress by legislative measures the value of silver?" Those who will study, without prejudice, the financial and commercial history of this country from the year 1816 to the present day, will emphatically answer "No!"

No nation, in or out of Europe, followed the example set by England of establishing gold as the exclusive legal standard of value, yet the value of silver nevertheless, and it may be said, of necessity, begun to fall at once. Our country had then, as it still has, the largest stock of silver possessed by any nation in the world, and as it could find no employment for currency purposes, silver coins serving merely as "tokens," in greatly restricted quantities, and as, moreover, the manufacture of silver into useful and ornamental objects was hampered by heavy taxation (33½ per cent.) upon the cost of the raw material, and by oppressive trade hindrances, the beautiful metal—intrinsically quite as precious as gold—flowed naturally abroad. India took it in enormous quantities, and, in a lesser degree, China and Japan, together with most of the countries of continental Europe. The consequence was that the relative value of silver compared to gold gradually fell, first in the States of Asia, chiefly our Indian Empire, and next all over the world, as indicated by the quotations at the world's commercial centre, the British Metropolis. While in the years previous to 1816 the comparative value of silver to gold stood at 15¼ to 1, the average of the next ten years was 15¾ to 1, and that of another decade 16 to 1. Then came a long standstill, which lasted until the year 1872, when, after the lapse of more than half a century, Germany, having obtained 200 millions of war indemnity from France, followed the example of Great Britain in the "demonetisation" of money. The more announcement of this resolution of the German Government caused a sort of panic in the bullion market, and the price of silver in relation to gold immediately went down from 16 to 1 to 17½ to one. Nothing more strikingly than this shows the effects of restrictive legislation upon the interchange of commodities. As yet the large silver mines in the United States of North America had not been discovered, and the whole stock of silver in the world remained precisely the same as before; still the bare notification that silver would be "demonetised" in Germany—a fact which in its ultimate results influenced but to a very trifling degree the relative proportions of gold and silver in existence—affected to an enormous degree the value of silver. So much for "value."

The first important effect of the sudden depreciation of silver, long foreseen by all who had studied the matter, was to disturb entirely the "exchanges" between Great Britain and her Indian Empire. The gold standard having been adopted by this country, while India knew only a silver standard, it was obvious that the fall in the value of silver should at once bring about the utmost confusion, which indeed it did. Lamentations and complaints arose on all sides, first in the Indian and then in the English press, until at last they found vent in Parliament. On March 3, 1876, the House of Commons resolved "that a Select Committee be appointed to consider and report upon the causes of the depreciation in the price of silver, and the effects of such depreciation upon the exchange between India and England." The Committee, presided over by Mr. Goschen, and comprising such eminent members as Mr. Fawcett, Mr. Baxter, and Mr. Kirkman Hodgson, began its sittings on March 20, 1876, and continued them until May 8, hearing during the time fourteen witnesses. Among the gentlemen who gave evidence upon the subject of the depreciation of silver the most notable were Mr. Robert Giffen, at the time on the staff of the *Economist*, at present head of the Statistical Department of the Board of Trade; Mr. Ernest Seyd, author of several standard works on currency and exchanges; and the late Mr. Walter Bagehot, the well-known political economist.

Mr. Giffen, after stating his belief that "the history has been that silver was really the principal money in use until about thirty years ago," and that "since then, gold has become the money in use to a very large extent, much more than it was," put in some papers showing the production of gold and silver throughout the world at various periods. Between the years 1852 and 1875 the production was as follows, in quinquennial periods:—

Annual Average of Five years	Gold	Silver	Proportion of Silver to Gold.
	Million £	Million £	
1852-56 . . .	29·9	8·1	0·27 to 1
1857-61 . . .	24·6	8·2	0·33 to 1
1862-66 . . .	22·7	9·9	0·44 to 1
1867-71 . . .	23·6	10·6	0·41 to 1
1871-75 . . .	20·4	13·9	0·68 to 1

The conclusion which Mr. Giffen drew from these figures was that, "in recent years, the fall in silver is not due to any excessive production as compared with gold, looking to the relations of the metals in past times, especially during the earlier parts of the century, but rather that the change of the metals has been such as more probably cause a fall in gold as a rise in silver." Mr. Giffen did not explain, not being asked to do so, that what was certainly the "more probable" future in the relations between silver and gold, the rise in silver and the fall in gold, had simply not come to pass because of restrictive legislation.

(*To be continued.*)

Enamelling.—It is stated that Dr. Gehring, of Landshut, has discovered a liquid composition which renders all kinds of stone and cement harder than granite, and simulates the aspect of the various minerals according to the taste of the operator. It is said to be applicable also to the coating of metals, and to be a preservative from rust.

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* A paper read at the Social Science Congress, Edinburgh.

A FEW WORDS ON GEMS AND PRECIOUS STONES.

By Edward J. Watherston, F.S.S.

(Concluded from page 79.)

THE question is often asked, and quite recently led to a discussion in the London papers, as to whether diamonds and other precious stones could be manufactured by some artificial process. "The diamond is but crystallised carbon," it is said. Aye, but it has taken Nature ages upon ages to do the work of crystallisation, and truly little has been done in the work. Can an oak tree, which takes generations for its growth, be "manufactured" in a few days, or weeks? The second question may be an answer to the first.

To sum up the philosophy, very curious in its way, as to the use and character of gems, it may be said in one word that they are "symbols." They were symbols of superstition in former times, and now they have become symbols of wealth. And what are "symbols"? Our "Chelsea Sage" makes reply in his own eloquent manner of word-painting. "Yes, friends," says Carlyle, in "Sartor Resartus," "not our logical, mensurative faculty, but our imaginative one, is King over us. Even for the basest sensualist, what is sense but the implement of phantasy the vessel it drinks out of? The understanding is indeed thy window; too clear thou canst not make it; but phantasy is thy eye, with its colour-giving retina, healthy or diseased. Have I not myself known five hundred living soldiers sabred into crows'-meat for a piece of glazed cotton which they called their flag, which, had you sold it at any market cross, would not have brought above three pence? . . . . It is through *symbols* that man, consciously or unconsciously, lives, works, and has his being. Those ages, moreover, are accounted the noblest which can the best recognise symbolical work, and prize it the highest."

It is undeniably true that among the oldest symbols of mankind—infinitely more ancient than "the piece of glazed cotton" which soldiers call their flag—are those rare and wonderful productions of nature, coveted in all ages, known as Gems, or precious stones.

THE JEWELLERY TRADE OF FRANCE AND GERMANY.

THE following interesting statistics are derived from a pamphlet issued by the jewellers of Geneva, who are antagonistic to the Control and Stamp which the watch-case makers of that city have asked the Federal Government to impose on gold and silver manufactures. It is stated that the export trade in jewellery has gradually diminished in France, owing to the hampering control and stamping laws. That country exported :—

In 1872, jewellery of the value of 85 million francs.
„ 1877, „ „ 63 „ „
„ 1879 „ „ 59 „ „

At the same time the production has rapidly increased. France produced :—

In 1847, jewellery worth 61 million francs.
„ 1876, „ „ 87 „ „
„ 1878, „ „ 96 „ „

Our authority then states that just the reverse has taken place in Germany, where this industry is free from Government interference. In Pforzheim, the German Birmingham, there were :—

In 1814, 36 factories with 1,200 workers, production 1 million francs.
„ 1838, 58 „ 2,000 „ „ not ascertained.
„ 1854, 82 „ 3,000 „ „ „
„ 1871, 278 „ 9,000 „ „ 46 million francs.
„ 1876, 312 „ 12,000 „ „ 75 „

It must be remarked that the jewellery trade of Pforzheim has lost much since 1877, but that is probably owing to the universal depression of trade.

Wedding Presents.—Large numbers of friends of the Rothschild family have attended by invitation at Mr. Alfred de Rothschild's house in Mayfair to inspect the wedding presents which preceded the nuptials of Mr. Leopold de Rothschild and Mdlle. Marie Perugia. Tables ranged along the sides of two rooms were covered with gifts of every imaginable kind that could be deemed appropriate to the occasion. The bridegroom and his mother, Baroness de Rothschild, have presented the bride with jewels of rare and costly beauty, which are the central attraction of the principal table. A diamond tiara shines resplendently above the group, to which it is a fitting crown. Beneath it, the offering of the Baroness, is a pearl necklace of four rows, accompanied by brooches, clasps, pendants, and studs, adapted for various changes of arrangement, the stones being all of great value. Two sapphires, of intensely deep colour, a large centre pearl, and a pear-shaped drop pearl, of perfect shape, are among them; and the diamonds which help to compose this beautiful suite are of important size and of first water. To the right of these jewels, a magnificent suite of emeralds, the gift of Baron Ferdinand, holds a prominent place, being, indeed, so conspicuous by their splendour that they could not easily be hidden or eclipsed. The Baron and Baroness Alphonse have sent splendid presents both to bride and bridegroom: Baron Charles of Frankfort is the donor of two large silver waiters; and the Baron Adolphe and most of the Rothschild family have hastened to testify their affectionate congratulations and good wishes. Sir Moses Montefiore has presented the bride with jewellery of sumptuous elegance. Lord Beaconsfield's offering is a golden dish, of exquisite design. Handsome cups, tankards, and services of plate are presented by "Friends hunting in the Vale of Aylesbury," and by "The Clerks at New Court," these last having given a silver-gilt dinner service of remarkable richness and grace of design. The presents of Lord Beaumont and Mr. and Mrs. C. Flower are among those of note. An oxidised silver centre-piece and two end-pieces supporting engraved glass bowls, constitute the wedding souvenir which has been presented by members of Tattersall's, together with an illuminated and emblazoned address of felicitation. Tenants, tradesmen, stewards, and servants at Gunnersbury Park, Ascott Farm, and various other estates of the Rothschilds have helped to swell the voluminous list of marriage-offerings. A background to the principal blaze of jewels is formed by a graceful trophy of fans, some of them old and rare, others of the most artistic modern design, material, and workmanship. Caskets, books, liqueur-cases, paper knives of tortoiseshell and carved ivory, jewelled walking sticks, parasols, riding and driving whips, clocks, and countless objects of ornament and use complete the display.

To Polish Aluminium.—M. Mouray recommends the use of an emulsion of equal parts of rum and olive oil, made by shaking these liquids together in a bottle. When a burnishing stone is used the peculiar black streaks first appearing should not cause vexation, since they do not injure the metal in the least, and may be removed with a woollen rag. The objects in question may also be brightened in potash-lye, in which case, however, care must be taken not to make use of too strong a lye. For cleaning purposes benzole has been found best. Objects of aluminium can be electro-plated without the least difficulty, and Mouray succeeded in imparting to them a bright white lustre in passing them successively through a weak bath of hydrofluoric acid and aquafortis. The effect thus obtained is said to be quite surprising.

The gold casket for the King of Greece, which Mr. J. W. Benson submitted to the Queen at Windsor, for Her Majesty's inspection, cost £300 to manufacture, but the Corporation only pay 100 guineas for it. The rewards of labour are not always direct and immediate.

CONSTRUCTION OF TIMEKEEPERS DELIVERED TO THE BOARD OF LONGITUDE, MARCH 7, 1805.

EARNSHAW'S ESCAPEMENT.*

(*Continued from page* 85.)

BALANCES are likewise spoiled by bending the compensation pieces, bending cracks, and destroys the compact body of the metal. The soldering up these cracks with a metal very different in expansion to the metal cracked is hurtful, nor is it possible to bend the compensation pieces into a true circle. In that case they form so many parts of different circles that nothing regular can be produced, nor a more inconsistent method of making expansion balances be imagined. The mode of making them, as well as the workmanship, are generally wretched in the extreme.

To adjust the balance in heat and cold, put the watch into about 85 or 90 degrees of heat by the common thermometer; mark down exactly how much it gains or loses in twelve hours in cold than in heat; move the compensation weights further from the arm of the balance about one-eighth of an inch, and if it gains one minute more in twelve hours in heat than in cold, move the weights one-eighth of an inch nearer to the arm of balance, and so on in the like proportion, trying again and again, till the watch goes the same in whatever change of heat or cold it is put in.

Much difficulty has fallen to the lot of watchmakers in the endeavour to make timekeepers go nearly the same in all positions; the inventor has had his share of this, but it is now over. By far the greatest part of this difficulty arises from the balance spring not being properly made. But if the spring is made, as shall be described hereafter, you have only to make the balance of equal weight, and it will go within a few seconds per day, in all positions alike; and if it vibrates not more than one circle and a quarter, a small matter of weight applied to that part of the balance which is downward when in the position that it loses most, will correct it with great accuracy; but if it vibrates more than one circle and a quarter, then it will require the weight to be above instead of below, and after the watch has been going a few months, and its vibration shortens to one circle and a quarter, then it will go worse and worse by reason of the weight being in the wrong place. To avoid this evil it is absolutely necessary to confine the vibrations to one circle and a quarter, which will produce the most steady performance. It is common for watchmakers to admire a timekeeper when they see it vibrate a circle and a half, or more, and form an opinion of its excellence from this only, but the inventor is aware from experience what would be the consequence, and has been condemned, because when he has seen such watches, he saw enough to declare that they would not give very accurate performance.

BALANCE SPRING.—To find out the invisible properties of this apparently simple part of the machine, has given much more trouble than all the rest. The inventor despaired of bringing timekeepers to the state he has done, and unless those hidden properties are known to timekeeper-makers, however well they may execute all other parts, they will find their most sanguine expectations frustrated. He has seen watchmakers boast of their timekeepers going well for a month or two; and, from the knowledge he had of the effects produced by the balance-spring, he has told them that a month or two more would destroy their hopes. To explain this, the cylindrical spring being in all its turns of equal distance from the centre, of course every turn will be of equal strength and called isochronal, and it has been believed that all vibrations, whether long or short, would be performed in the same time; but this is not true, for if a man is to go four miles in the same time that he has gone one mile, he cannot do it with the same power; no; he must have impelling force to quicken his motion, or he will be four times as long in doing it. Therefore, instead of the spring being equal in all its parts, it must be made to increase in thickness to the outer end, in such proportion as will cause the balance, when thrown to a greater distance, to return so much the quicker to make them equal. By long perseverance he found how to make such springs, and then he thought he had got all he wished for, but cruel disappointment nearly broke his heart, for he found he had yet another difficulty to break down, as his watches with such perfect springs were continually losing on their rates. What further to do he was long at a loss to determine, but, obstinate in the cause, and resolving not to give it up but with his life, perseverance came once more to his aid, and with still more unremitting study, he at length applied the following remedy:—He found in the course of reasoning on bodies that watch springs relax and tire like the human frame when kept constantly in motion, and this may be proved by the following experiment.—Let a watch that has been going a few months go down; let it be down for a week or two or more, then set it going, and if it be a good timekeeper so as not to be affected by the weather, it will go some seconds per day faster than it did when it was let down; but it will again lose its quickness in a gradual manner, gaining less and less till it comes to its former rate. Therefore finding that isochronal springs would not do, and likewise having made springs of such shape as would render long and short vibrations equal in time, constantly lose the longer the watch went, he then made them of such a shape as to gain in the short vibrations about five or six seconds per day more than the long ones; this quantity could only be found by long experience, and the way he proved this was to try the rate of the watch with the balance vibrating about one-third of a circle, then tried its rate vibrating one circle and a quarter, and if the short vibrations go slower than the long ones, that watch will lose on its rate; and if they are equal it will likewise lose, but that only from relaxation; and if it gains in the short vibrations more than five or six seconds in twenty-four hours, it will ultimately gain on its rate; but if not more than that quantity, and the timekeeper is perfect in heat and cold, and every other part, the above properties will render it deserving of the name of a perfect timekeeper; and this is a principal cause of his timekeepers excelling others, and also of some of his timekeepers going better than others, though made by himself, the springs of them being made to accord more exactly with the above proportions; and this is the cause which has enabled him to foretell what his timekeepers would do, which Dr. Masklyne Crosley and others could testify. The above effect is produced as follows: he finds the common relaxation of balance-springs to be about five or six seconds per day on their rates in the course of a year; therefore the short vibrations are made, by the shape of the springs, to go about that quantity faster than the long ones, and as the spring relaxes in going by time, so the watch accumulates in dirt and thickening of the oil, which shortens the vibrations, the short ones then being quicker compensated for the evil of relaxation of the balance-spring. From this it is plain that the causes of error in timekeepers are not undefined and vague in their nature, which has been supposed; for when it is certain that all causes of error may be over compensated, we cannot despair of finding out the medium, which may be easily proved by examining the going of the inventors timekeepers. It will then appear that what errors they are subject to arise from causes certain and natural, and of course they may be corrected by art.

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* Earnshaw's own description from "Smith's Compendium of Practical Inventions." Liverpool, 1816.

The detached escapement is a dead scape, if properly unlocked as here done, on the outside of the wheel. The unlocking on the inside is improper, being against the whole train of wheels, and causes a recoil. When the wheel is locked on the heel of the tooth instead of the extremity, the absurdity is too plain to the meanest mechanic to need any comment; the notches cut by the pallet rubbing on the round face of the scape-wheel teeth clearly prove how much friction presides there, and such a wheel is much more difficult to make than the one proposed. The size of pallet selected also tends most effectually to prevent watches from stopping.

(*To be continued.*)

BILLS OF SALE.

Hedges, Thomas, 13, Trinity Place, Oxford Road, Reading, Berks, tin case and watchmaker. Dec. 23. £15, &c. Given to Thomas Richards.

Collins, Henry, 109, Oxford Street, Bond Street, Sheffield, silversmith. Dec. 24. £8, &c. Given to William Ashby.

Simpson, James, 57, Rahere Street, Goswell Road, gold chain maker. Dec. 24. £24 17s., &c. Given to Thomas Hyland.

Turner, Thomas, Meadow Row, Elsecar, Yorkshire, hairdresser and watchmaker. Dec. 24. £13 2s. 6d. Given to William Ashby.

Bowden, Robert Walker, 3, Globe Street, Scarborough, Yorkshire, dealer in fancy goods. Dec. 29. £14 6s., &c. Given to the Commercial Loan Company.

Brown, William, 3, Durham Cottages, Scarborough, jet worker. Dec. 29. £10 8s., &c. Given to the Commercial Loan Company.

Davies, Samuel, 2, Mina Villa, Chapel Road, and 1½, Chapel Street, Abergavenny, Monmouthshire, watchmaker. Dec. 30. £14. Given to Joseph Blaiberg.

Tragheim, Bernard, 7, Lawton Street, Newcastle, watchmaker. Dec. 31. £15, &c. Given to A. Jacobs and Co.

Barlow, John, 164, Pitsford Street, Hockley, near Birmingham, silversmith. Jan. 1. £21. Given to Arthur Johnson.

Rigby, Edward John, 47, Normanton Road, Derby, jeweller and watchmaker. Jan. 3. £30, &c. Given to Harris M. Beirnstein.

Packer, James Thomas, 36, Heaton Road, Peckham Rye, silversmith. Jan. 5. £30. Given to Hugh Brown.

Howe, John, Quarrington Hill, near Coxhoe, Durham, jeweller, hardwareman and publican. Jan. 6. £48. Given to Myer Asher.

King, Augustus, 41, Traffic Street, Derby, tobacconist and jeweller. Jan. 6. £29, &c. Given to Meyer L. Mindelsohn.

McElroy, William, 524, Oldham Road, Manchester, jeweller, &c. Jan. 6. £1,590. Given to David McElroy.

Farmer, Robert John, 5½, Coney Street, York, optician. Jan. 7. £250 indem. Given to Alfred Rapkin.

Ferguson, Peter, 42, Dame Street, Islington, watchmaker. Jan. 7. £11 5s. Given to the London and County Advance Company.

Job, Joseph Hadden, 8, South Colonade, St. Leonards, Hastings, clock maker. Jan. 7. £77, &c. Given to the Mutual Loan Fund Association.

Bell, John Henry, 341 and 343, Scotswood Road, Newcastle, jeweller, &c., and Margaret Bell, ditto, widow. Jan. 10. £86 9s. 10d. Given to Morris Davis.

Hammersley, Joseph, 22, Witton Street, Northwich, watchmaker, and William Hibbard, 62, Witton Street, Northwich, Cheshire, hairdresser. Jan. 10. £15. Given to the Northwich Advance Office.

Trevor, Richard, 2, East Arran Street, Dublin, watchmaker. Jan. 10. £7, &c. Given to Baron J. Cohen.

Monkman, Charles, Frier's Gardens, Scarborough, jet worker, John Fox, Durham Street, Scarborough, jet worker, and Alfred Monkman, Bow Street, Scarborough, jet worker. Jan. 12. £14 6s., &c. Given to the Commercial Loan Company.

Reading, Thomas, 7, Alexandra Place, Whitehead Road, Aston, Warwickshire, jeweller. Jan. 12. £7 15s., &c. Given to Henry Collins and another.

Tate, William Alfred, 38, Erskine Street, and 9, Soho Street, Liverpool, watchmaker, &c. Jan. 13. £72, &c. Given to Jane Manning.

Page, Newton Thomas, 22, Colebrooke Row, Islington, manufacturing jeweller. Jan. 14. £290, &c. Given to Michael Zeffertt.

Rinzi, Ernest, 29, Golden Square, manufacturing jeweller. Jan. 15. £120, &c. Given to the Charing Cross Bank.

Willows, Bransby Hope, 6, Collingwood Street, and 80, Cazneau Street, Liverpool, watchmaker, &c. Jan. 15. £10, &c. Given to Nathan Cohen.

Muller, John, trading as M. Lina (by Sheriff), 399, Edgware Road, jeweller. Jan. 17. £40. Given to Charles Burlls.

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CONTENTS.

	PAGE
Machine Work *versus* Hand Work (A Reply to James U. Poole)	107
A Monster Diamond	108
Practical Instructions to Jewellers, Silversmiths and Electro-platers	109
The Construction of a Simple but Mechanically Perfect Watch	110
The Clockmakers' Company's Library	111
Repairing Swiss Watches	112
Queries and Answers	113
Watches at the Melbourne International	113
The Goldsmiths' and Silversmiths' Free Trade Association	113
The Goldsmiths and their Discipline	113
Lectures on Watch and Clock Making	114
Watchmaking	116
Hall-Marking	119
Bronzes	120
Jewellery, Silver and Electro-Plate at the Melbourne International Exhibition	121
Exhibition at La Chaux-de-Fonds (Switzerland)	122
The Art of the Silversmith	122
Bills of Sale	ii
Patents	iii
Monthly Record of Bankruptcies	iv
Directory	vi
Advertisements	i—xvi

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MACHINE WORK *versus* HAND WORK.

A Reply to Mr. James U. Poole.

No. III.

(*Continued from page* 90.)

Mr. POOLE now favours us with an extract (page 41, October No. of this Journal) from a letter written by the practical representative of one of the oldest established watchmaking businesses in America, which he thinks is quite appropriate to the present topic. Speaking of the American watch factories, he says: "The trouble with those here is that they are entirely in the hands of machinists whose interests are of course to keep the business as far as possible in their own hands. We have long thought that the best results would be obtained only when machine work was supplemented by hand work."

This is one of many proofs we have of imperfection in the American system of watch manufacture, and as it comes from the pen of an American writer it carries with it a degree of conviction that it would fail to have if the same words had escaped from the lips of a man who was of another nation, and is there not here a salutary caution to those who so frequently express a desire to go to the United States for machinists and machine tools? I have taken some little trouble to enquire into this matter, and I venture the opinion that the much needed balm for English horology will not come to us from America, but rather from the concentration of our energies in developing the resources we have at home; and while I am among those who will gladly welcome any improvement, no matter from which side of the Atlantic it may come, I would prefer that we render to America in the future the service we have done in the past.

I have already observed that the machine system in America has been allowed to run into the same excess that hand work has in Clerkenwell; and in addition to this defect, which may be said to be of a mechanical character, it appears from the extract before us that there is another certain overreaching tendency on the part of machinists, which may be said to be a moral defect, and is not under discussion in the present paper, and therefore lacks the appropriateness for the present topic which Mr. Poole claims. The object of the American watchmaker in the extract before us is to correct this abuse.

Mr. Poole says, "In order to keep up the supply of this skilled hand work a special training is required, and I propose to go back some 25 years and detail some of the methods by which the art and mystery of watchmaking was inducted into young beginners, taking the lever escapement as the illustration. In those days, and previously, elaborate tools were little used; the old legend of a nail and a piece of cork had more significance then than now. Just as our young seamen are supposed to be better trained in sailing vessels than steamers, even at the risk of going to the bottom, as in the cases of the "Eurydice" and "Atalanta," so our young beginners were taught to depend upon their own ingenuity for many of the methods they employed in doing their work."

In the desire to go back—to continue in the old style with the risk of going to the bottom—you have the keynote of Mr. Poole's letters. The desire to take one step forward with certainty of going to the top and you have pivots on which this controversy turns.

Nor let it be thought for one moment that in either of these desires there is freedom from liability to err; both are alike exposed to danger. The only safe policy is to be very conservative of every old system of manufacture that retains its usefulness, and to be liberally disposed only to those innovations that bring with them substantial proof of their advantage.

"Twenty-five years ago and previously, elaborate tools were very little used. In those days the old legend of *a nail and piece of cork* had more significance than now."

This statement is no doubt to some extent true so far as Birmingham, Prescot, and Coventry are concerned; yet if we may judge of a tree by the fruit it bears, much remains to be accomplished in each of these places.

But so far as the great mass of the trade is concerned, it is the reverse of truth, for then our workmen used more elaborate English tools than they can obtain to-day. Twenty-five years ago Leyland (a celebrated tool maker at Prescot) was making lathes for American watch factories and I remember, in a conversation with Mr. Denison; the venerable father of American watchmaking, that he paid a very high compliment to work that Leyland had made for him. Twenty-five years ago and previously, you could purchase in Clerkenwell almost any amount of English mandrills with slide and swing rests mounted on iron beds, with jewelling lathes, chucks, back-centres, etc.; and any tool at that time, no matter how elaborate, could be easily made. Go through Clerkenwell to-day, and though you will find an abundance of nails and cork, such English tools cannot be purchased.

Evidently about the time Mr. Poole was preparing his October letter for the press I was in Prescot, carefully examining the state of the watch tool trade there; and I am ashamed in these pages to detail its depressed condition, in fact it has almost left the place, and with it is going the watch trade also, and that we are sailing on board the "Eurydice" and "Atalanta," that are slowly but surely going to the bottom, there cannot be the slightest doubt. The returns issued by the Board of Trade, with which you are doubtless painfully familiar, sufficiently prove the truth of this statement, and if we are wise men the question we shall ask is this—What shall we do?

Naturalists tell us that rats show their wisdom by deserting an ill-fated or sinking ship. How do these cunning little vermin arrive at a knowledge of the unseaworthiness of their vessel? Do they form themselves into a society? hold meetings? give evidence before a chairman of the unsound state of the ship? Do they propose resolutions? I cannot answer any of these questions. One thing I know, it is this, they *act*, and seize upon the first opportunity for safety; and to be constantly talking, writing, lecturing on the defects of English watchmaking, without taking steps for remedying these defects, is to show less wisdom than rats.

Doubtless any watchmaker who lives near to the banks of the Mersey or the mouth of the Thames, may, if he thinks fit, verify this observation of naturalists; but the question I want to ask Mr. Poole and every reader of my paper is this. Shall we show our wisdom in deserting the good old ship in which we sail? No gentlemen, certainly not. We will show our wisdom in repairing it, for I am persuaded that some of

"Her timbers yet are sound,
And she may float again,
Full charged with England's *lightning*,
And plough the distant main."

Before I pass from this apt illustration I readily admit our young seamen may be better trained in sailing vessels than steamers. The more frequent use of the sails will produce a better knowledge of management of ropes, etc., though these things are by no means abolished on a steamer; but the sailing vessel, like the slow coach, fails in expedition, and it would be just about as reasonable to condemn the use of steamers because they do not offer such full scope in learning the art of navigation, as it would be to condemn the use of machinery in watchmaking because, forsooth, the art of watchmaking cannot be entirely learnt in a machine shop.

So those young beginners who, twenty-five years ago and previously, were taught that most valuable lesson, *to depend upon their own ingenuity* for many of the methods employed in doing their work, have, with an increasing trade, made many improvements, the reception of which in this country is by no means satisfactory.

I hasten to consider the best and most suggestive sentence in Mr. Poole's letter. While I write I have before me a gold pocket chronometer made by my grandfather sixty years ago, which is in perfect condition and contains all its original parts, including the mainspring!!! The admiration we feel for the achievements of English horologists who flourished during the latter end of the last and the early part of the present century is not easily expressed. It is the only subject upon which we can descant with any degree of complacency; hence its frequent repetition. I am of opinion that no good purpose is served by constantly parading this ground over and over again, but that we may be better employed by endeavouring to ascertain the cause of the disparity that exists between the English watchmaker of the past and the present time.

Richard Whittaker.

(*To be continued.*)

A MONSTER DIAMOND.

Messrs. William Ford & Co., Diamond Polishers, of Clerkenwell Green, had the advantage of exhibiting the finest rough diamond that has been brought to this country for many years. It is certainly the whitest stone of a large size that has been seen in England for a very long period, far eclipsing the Koh-i-noor for purity of colour; it appears perfectly free of all flaws and impurities, and weighs at the present time 150 carats (1 ounce). This, however, was not its original weight, for it has lost two fragments (probably of some size) by natural cleavage. The planes developed by this are parallel to those of the octahedron, which is the direction of cleavage characterising this mineral. The weight of these fragments is estimated to have been at the lowest 10 carats and 20 carats respectively, so that the total original weight would not be under 180 carats, though the probability is that it exceeded this. It exhibits the planes of the rhombic-dodecahedron somewhat rounded, as is frequently the case with the diamond. It was found at Kimberley, South Africa, on February 13th, 1880, on the claim of Mr. Porter Rhodes, by whom it was brought to England last January. With regard to the cleavage of this stone, it is a well authenticated fact that some colourless diamonds do split into many pieces without any apparent reason, instances having occurred in which such stones being locked up securely overnight in an iron safe being found scattered about in fragments in the morning. Whether this be owing to the expansion of enclosed gases, or to a state of tension in which the crystal may be said to exist is still an open question.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. XXIII.

(Continued from page 91.)

Second Formula.

Phosphate of soda, 14 ounces.
Bisulphite of soda, $3\frac{1}{2}$ ounces.
Bicarbonate of potash, $1\frac{3}{4}$ ounces.
Caustic potash, $1\frac{3}{4}$ ounces.
Cyanide of potassium, $\frac{1}{2}$ ounce.
Pure gold for neutral chloride, $\frac{1}{2}$ ounce.
Distilled water, $2\frac{1}{5}$ gallons.

All the substances except the chloride of gold may be dissolved together, and filtered if necessary; then the solution of chloride of gold is added. This bath is heated at from 120° to 140° Fahr., and produces a very fine gilding, but it requires an intense electric current. It is not suitable for the direct gilding of iron or steel.

Third Formula.

Yellow prussiate of potash, $5\frac{1}{4}$ ounces.
Carbonate of potash, pure, $1\frac{3}{4}$ ounces.
Hydrochlorate of ammonia, $\frac{2}{3}$ ounce.
Pure gold for neutral chloride, $\frac{1}{3}$ ounce.
Water, 1 gallon.

Dissolve the first three salts in hot water, and filter the solution; after cooling add the gold solution and boil for half-an-hour, taking care to replace the evaporated water.

Fourth Formula.

Pure cyanide of potassium, $1\frac{3}{4}$ ounces.
Pure gold for neutral chloride, $\frac{1}{3}$ ounce.
Water, 5 pints.

Dissolve the chloride of gold in the whole of the water, and add the cyanide, which dissolves and makes the liquor colourless. This bath may be employed with little regard to temperature, and is simple in its ingredients. Unfortunately it is not uniform in its working, as it will ungild one face of the object while the other face becomes gilt, or may produce a red gilding at the bottom and a yellow one at the top. These inconveniences will partly disappear by a long ebullition.

The first formula is alone suitable for the direct gilding of iron, polished cast iron and steel; a deposit can be effected also by the other recipes, but the gold has as a rule very little adherence, and sometimes none at all. For gilding polished steel without the interposition of copper, it is advisable, as already stated, to reduce the quantity of cyanide given in the first formula by one-half. The bath must therefore have $\frac{1}{6}$ ounce of cyanide to $\frac{1}{3}$ ounce of gold. The steel articles after cleaning are rapidly passed through a weak hydrochloric acid bath, then wiped if possible, and put into the gilding bath very hot and under the influence of an intense current; the force of the latter is gradually diminished by a gradual withdrawal of the platinum anode. Small steel articles such as pens, watch-hands, etc., are threaded on a thin brass wire and kept apart from each other by glass beads. When they have undergone the cleansing processes, they are rapidly gilt in the boiling bath, then rinsed, and dried in dry and hot sawdust. Steel blued by heat can be whitened immediately by passing it through diluted hydrochloric acid, say one part of acid to ten parts of water.

General Observations on Hot Gold Baths.—The hot baths like the cold ones may be more concentrated, the quantity of water may be diminished, without changing the proportions of the salts and of the gold; in my practice I have however found it is preferable to use diluted solutions, which deliver the metal in smaller quantity in a given time, but more homogeneous in substance.

Instead of suspending the articles in hot baths, it is well to keep them in constant agitation, which secures continual change among the layers of the liquor and a gilding of a uniform colour.

A foil or a wire of platinum is preferred to a soluble anode of gold when electro-gilding by the aid of heat, as it is not dissolved, and is more handy for regulating the intensity of the current by immersing it more or less in the liquid. Thus with the same bath and battery three different shades can be obtained; a pale colour with the anode dipping but slightly, a yellow colour, when the immersion is greater, and a red gold if the whole anode is in the liquor. In a bath of pink gold, composed of gold, copper, and silver, by increasing or diminishing the length of the platinum anode in the liquor, the deposit will have a white yellow, or red shade, as the various metals require different degrees of intensity for their reduction in the galvanic current.

In hot electro-gilding baths and especially with small articles, keep them in the right hand constantly moving in the liquid, while the left hand is employed in changing the position of the platinum anode, so as to suit the surface and the nature of the articles, and to obtain the desired shade.

The hot baths may have their strength maintained by successive additions of chloride of gold with a proper proportion of the other salts, but it is preferable to wear out the bath entirely and to prepare a new one. When a bath is exhausted, the gilding is red if much copper has been gilt in it; and green in the case of silver articles. It may then be used for a first coat upon objects which are to be finished in a new bath. Thus green and white golds result from the simultaneous deposit of gold or silver in various proportions; red gold from the alloy of copper and gold; and pink gold from the combination of gold, silver, and copper.

Green and White Golds.—Add to one of the above baths a solution of the double cyanide of silver and potassium or a diluted solution of nitrate of silver, until the desired shade is obtained. The tints will vary from a leek green to a very pale whitish yellow. This kind of gilding mixed upon the same articles with red, yellow, or pink gold, will produce splendid effects of contrast, especially upon chased parts, where the green gold has a velvety lustre.

Red Gold.—Mix in suitable proportions the electro-copper bath already described with one of the baths for electro-gilding; or use an old bath in which a great many copper articles have been gilt, with an intense current of electricity. Yellow gilding may be made to pass to red, by heating it after it has been covered with a paste of acetate of copper, cream of tartar and common salt. Plunge the heated piece into a weak solution of sulphuric acid, and carefully scratch-brush afterwards.

Pink Gold or New Gold.—This kind of gilding is the most difficult to obtain on account of the different tendency of the various metals to galvanic decomposition. Pink gilding to be perfect should present at the same time the red, yellow and white shades in such a manner that a practised eye will distinguish them. The articles are first gilt yellow by the pyrophosphate bath for dipping, or by the hot electro bath. Then, without drying, but keeping them in fresh water, small packages are made weighing from 1 ounce to 2 ounces each; pass lightly through the mercurial solution and then red gilt in an old and hot bath where a great deal of copper has already been gilt, or in a new bath composed of ten parts of hot electro-gilding bath, first formula, and three to four parts of the first coppering solution with battery.

(To be continued.)

THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.*

By M. Grossmann, Watch Manufacturer,
Glashuette (Saxony).

(*Continued from page* 92.)

71. The dial of the watch, though of a material rather inconvenient to handle, is not much open to alterations. The liability to injury of the enamel dial has led to many endeavours to replace it by some more appropriate material. But the principal considerations of a good dial, distinctness, has never been attained in such perfection as with the enamelled ones. A perfectly white surface, with deep black figures on it, cannot be surpassed for this purpose. Silver dials, which were intended to supplant enamel, have nearly the same whiteness when new, but they are very liable to get dark from atmospheric influences or careless handling. Gold dials have also been tried, but they are much less distinct, and especially a gold dial with gold figures and gold hands, may be considered a nuisance, as in any place where there is not broad daylight, and to any person who is not endowed with a very sharp sight, it is impossible to derive any benefit from a watch fitted out in that way.

For these reasons the enamel dial, in spite of its fragility and additional thickness is, and will be, kept in use by all those who do not leave out of sight its principal purpose; but it cannot be denied that the invention of a metallic or other more appropriate material, possessed of the indispensable qualities, would indeed prove a great progress in practical horology. Here is ample room for useful inventions. There was a period when, in England and elsewhere, dials were preferred of a yellowish or grayish tint. These are, of course, not so fit for the purpose as those of pure white enamel. In the same way the slightly frosted surface of the English dials is thought a great improvement, as it is said to allow of looking at the watch in any direction without being disturbed by the reflection of the dial surface. This is a strange mistake, for if the dial of a watch does not reflect when held in an awkward direction, the glass over it certainly will do so. Besides, it is so very easy to look at a watch without any danger of annoying reflex.

72. The fastening of the dial in its position is effected by pins or screws. It is not advisable to fix the dial with two small screws and holes drilled through it, because the dial is very much exposed to injury by the slightest sideward pressure when shutting the case, the holes being so very near the edge of the dial. This method of fastening dials was formerly preferred by the best French and Swiss makers, and many a fine dial has been spoiled by it.

A dial fastened in this way requires some care of the repairer when putting it on. He ought to screw both the screws gently down, but afterwards to release each of them by about ¼ of a turn, so as to ease the dial in its position.

Another way of fastening the dial is with pillars, or feet and pins. It is quite efficient, and involves no danger, therefore it has been much in favour in English watches; and, if the movement can be got at, there is nothing to be said against it. But in the movements of the present period, the greater part of which do not open with a joint, the fastening with pins would be rather troublesome, because, for taking off the dial, it would be necessary to take the movement out of the case.

In all movements cased in this way the dial pillars ought to be held by key screws which allow taking off the dial without removing the movements.

A very good method of fastening the dial is to set it in a thin rim of silver or gold, and adjust this rim nicely on the outer edge of the pillar plate. Then, of course, the dial requires no feet, and all the difficulties resulting of collisions of these feet with the parts under the dial of complicated watches are done away with.

73. The hands, in order to be distinctly seen, ought to be of a dark colour, and the generally adopted blue steel is far preferable to gold for this purpose, and the figures and hands ought to be a little more substantial than the present taste prescribes for them. The most convenient shape for the purpose is the spade pattern; the Breguet and the Fleur-de-Lis hands not being so easily distinguished.

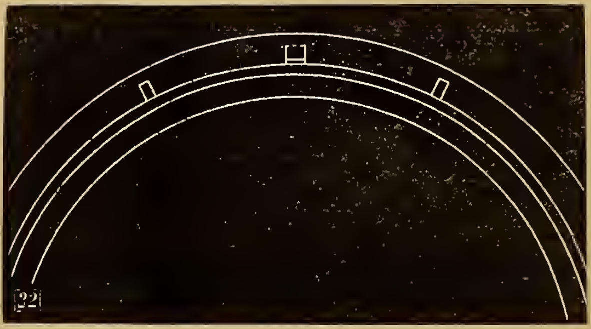

Fig. 25.

74. The circle of seconds ought to have every fifth degree visibly marked by a longer and stronger stroke, in order to facilitate the reading of the seconds.

Formerly all the dials had flat seconds, but since about thirty years it has been quite common to have sunk seconds, even for inferior watches. There is some advantage in that, especially in flat watches, where it affords accommodation for the seconds-hand, but at the same time it weakens the dial considerably. This may be the reason why some makers have the sunk part much smaller, and the seconds painted on the main dial, the lines extending inward to the edge of the sink. The seconds-hand is then shorter, and moves in the sink.

The dial ought never to be made larger than the pillar plate.

CHAPTER VIII.

The Escapement.

75. It cannot be the object of this treatise to describe and illustrate the various escapements, or to discuss their relative merits. We have merely to occupy ourselves with the exterior parts of construction, which serve to bring the escapement in its place, and to keep it steady there.

76. To begin with the horizontal or cylinder escapement, I always thought the "chariot," a movable fastening of both the balance cocks, a rather superfluous complication. If the distance between the cylinder and wheel has been correctly pitched, it is only desirable to keep it intact, and the movability of the chariot is a danger for the good performance of the watch. On the other hand, no one will pretend that the correct pitching of a cylinder escapement will be a very difficult job, while the duplex escapement, requiring by its delicate nature the most perfect accuracy, is, in the majority of cases, planted without movable chariot; besides, the cylinder escapement admits, more than all the other escapements, of being manufactured and planted by the system of perfect identity, and it would seem advisable to take advantage of this circumstance. The suppression of the chariot would render the movement more simple and easier of execution to a considerable extent, because the lower balance cock could then be omitted, by setting the balance hole in the same way as that of the wheel in the bridge; or, in the absence of this, in the plate itself. The necessity of the chariot is only a prejudice originated by

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habit and blind routine. If a cylinder escapement then is correctly pitched, it will be so for over, and no inexperienced hand would be able to alter it; and as to those escapements which are incorrectly pitched, they ought not to pass examination without being corrected.

(*To be continued.*)

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—I feel indebted to Messrs. Robbins and Appleton for having specially drawn attention to a somewhat obscure sentence.

The meaning I intended to convey, and which is borne out by the sense of the paper as a whole, was, that as a very large proportion of *similar* work to that produced by the American watch companies (not Waltham alone) was already being executed in this country, there was no reason why we (in Clerkenwell) could not manufacture on the same system.

Messrs. Robbins and Appleton have now had the opportunity of stating officially that every part of their *movements* are *made* WHOLLY at their factory in Waltham, but in their reply to Mr. Glasgow which appeared in a contemporary on May 15th, last year, they adviso him to take a few lessons from Mr. Ganney. Consequently, as Mr. Ganney stated at the Horological Institute on April 28 that "dials and cases were actually made in Clerkenwell for American watches, and dials were sent over to America in large quantities;" and another gentleman said, the following month, "Why did the Americans come to Clerkenwell for their dials, cases, and best hands, and have their jewel holes made here"? it is not surprising that a general misapprehension should exist as to the system of American manufacture.

It is generally known that the very large order given to a Clerkenwell dial maker last year emanated from a rival company to the Waltham; and my contention is that English dials and English cases (although forming no part of the system of manufacturing movements) can only be used for the purpose of giving an English appearance to the complete articles, so as to accommodate them to the notions of the public, who, in the words of a well-known gentleman, while giving evidence before the Select Committee on Hall Marking in 1878, "are under the impression that there is no watch like an English watch."

I am, &c.,
James U. Poole.

THE CLOCKMAKERS' COMPANY'S LIBRARY.

PROBABLY it may not be known to some of our readers that there are deposited in the Free Library of the Corporation of the City of London, books, manuscripts, specimens of clocks, watches, watch work, etc., formerly in the library and museum of the Worshipful Company of Clockmakers, a catalogue of which was published by them in 1830. Several additional volumes having been included in the library, as well as many articles added to the museum, it was thoughtfully suggested by the Company, and gracefully acceded to by tho Corporation of the City, that it was desirable to place this library and museum where they could be more accessible, and consequently more useful to the public in general. With a generous accordance, which cannot be too highly appreciated, arrangements were soon concluded, and the valuable collection found suitable accommodation in the noble library of the Corporation of London.

Aware of the advantage of this acquisition, the Court of Assistants, recognising the necessity of reprinting the catalogue, resolved—"That a new catalogue of the books in the Company's Library be compiled by Mr. W. H. Overall, the said catalogue to contain the MSS. recently arranged by him, and also the collection of clocks, watches, and watch movements, and all other articles belonging to the Company recently deposited in the Guildhall Library and Museum of the City of London."

Mr. Overall has well executed his task, and has compiled a clear and lucid resumé of this collection, which was published in 1875.

Extracting from this wo read—"There are probably few subjects connected with science upon which so little has been published in this country (except occasionally in periodical publications) as those relating to the theory and practice of clock and watch making. The paucity of works upon this subject is the more surprising when its importance, as connected with the maritime greatness and commercial prosperity of the British dominions, is duly considered." "The productions of our neighbours, the French, relating to the science of horology, are much more numerous, and several of them are extremely curious and interesting." Continuing our extracts we read—"Many individuals, from the difficulty of acquiring a general knowledge of the various inventions and improvements which havo been made in this branch of science, have lost much valuable time, and incurred a great expense in bringing forward inventions which they supposed to be new, and in many cases in procuring patents of which printed descriptions were already in existence. Could those persons have had access to any published collection of works upon horology, it is more than probable that much time would have been spared and inconvenience avoided."

Fully coinciding with these views, we believe we are rendering a service to many of our readers in calling attention to the subject, and in particularising some of its details. The facility of entrance to the City Library (simply recording your name), and the extension of time in the evening, will enable even our country readers, during a limited stay in London, to avail themselves of the resources of the institution, and to obtain for themselves much useful information which they might in vain seek elsewhere.

The contents of the catalogue are thus specified:—Books, pp. 1 to 39; manuscripts, to 62; prints, to 65; specimens, 65 to 97, as also portraits, &c.

Of the books we need only remark that overything bearing on this special subject seems to have been collected, some of them being rare, and not even to be met with in the British Museum. The manuscripts mostly relate to the charter and general business of the company, with other papers, but few of technical interest. The prints, of various dates, are mostly designs or representations of clocks; but the specimens, both English and foreign, are highly interesting, showing the advance of the art, and in many cases suggestive of further progress and improvement. We strongly recommend our readers to devote an hour or two to their inspection, as well as to the portraits of the old masters, the Patriarchs of watchmaking.

To Render Ivory Flexible.—Ivory is readily rendered quite flexible by immersion in a solution of pure phosphoric acid (specific gravity 1.13) until it loses, or partially loses, its opacity, when it is washed in clean cold water and dried. In this state it is as flexible as leather, but gradually hardens by exposure to dry air. Immersion in hot water, however, restores its softness and pliancy. The following method may also be employed:—Put the ivory to soak in three ounces nitric acid mixed with fifteen ounces water. In three or four days the ivory will be soft.

REPAIRING SWISS WATCHES.

No. VI.

By H. GANNEY.

(*Continued from page 94.*)

THE replacing of the various parts of the Swiss barrel works varies in difficulty with the various plans used in connection with this part of the watch. Where the barrel is supported by a bar from the bottom, replacing a ratchet or barrel arbor are the most simple and elementary jobs connected with watch work, but where, as is most common, the barrel has no bottom bar, then the replacing an arbor or ratchet, both being combined, becomes a task requiring an amount of care and skill to make a perfect job equalling anything that taxes the watch repairer's skill and patience; for though the work is not very fine, yet the fittings are very close, and the amount of turning and polishing may be of a very high class with advantage. The arbors are to be purchased in two forms, one, simply as a large arbor with a ratchet, to which the repairer fits the old inside arbor, or as an arbor with a certain amount of finish in the various parts. Whichever form is used, it is necessary to first see that the ratchet is as large as the sink of the bar will permit, and that the teeth are not too fine, or a new click may be required to work with the ratchet. The condition of the hole in the bar next demands attention, and if the arbor is near the size already, time and trouble will be saved, and the hole improved by opening it with a round broach to fit, as the finish is usually very good at this part of the arbor as bought. If the old arbor and barrel were right in their respective actions and freedoms, the pinion gauges should be used to transfer the old sizes to the new arbor, not forgetting to use the round broach to the barrel-holes and renew them, as it is impossible to try the freedom and heights in the watch until the bearings of the barrel are finished, and when finished they cannot without spoiling be altered. Considerable judgment is required to finish all simultaneously, so as not to require any alterations; as the pivot that works in the bar is also the shoulder against which the barrel works, the position and freedom of these must be made together. A very small portion of the arbor coming through the bar is generally sufficient to give the required freedom to the barrel, and the same rule applies to the arbor on which the barrel works, which must have enough arbor through the barrel to allow of screwing home the arbor without binding the barrel, and the end shake of the barrel may be made the freedom at this part, or if excessive, a shoulder must be left on the pivot that runs in the barrel cover. The fitting of the stop finger and drilling a hole in the small square to hold it on, completes the job, which should be well tested in all parts to secure perfect freedom. As this is usually a long job, want of care in the final stages may render all previous work labour in vain. The replacing of the barrel is not a very troublesome job, unless the repairer makes his own barrel—an unprofitable proceeding, as barrels are easily obtained; but a piece of thick, flat brass in the mandrel may be turned out suitable size and form if the jobber is determined to make his own barrel, and a screw arbor will provide the necessary facilities for finishing the outside portions preparatory to cutting the teeth in a wheel-cutting engine.

Barrel bridges are also obtainable, and seldom worth the trouble of entirely making, unless to a watch of old style not obtainable. The principal trouble in making a barrel bar, is the work connected with the small brass cap and its four screws; two screws are enough if well made. And if a new ratchet or barrel arbor is required, and the barrel has a bottom bar to support it, advantage may be taken of the circumstance to put a plain bar like an English namepiece, with a simple hole only in it, and using a solid ratchet and arbor. Sink the ratchet in from underneath the bar, and we have a stronger and better arrangement than the ordinary one with much less trouble. Broken teeth in barrels are usually replaced by a brass pin with the ends made a suitable shape. Where the barrel is too thin to allow a hole of proper size to make a brass pin of sufficient strength, a steel pin may with advantage be substituted. Bent teeth may be raised by careful pressure with a knife blade a little at a time in the required direction.

Believing there are few points about the barrel we have not now thoroughly discussed, we will leave this part of the watch, with the observation that most of the difficulties are caused by the manufacturer supporting his barrel by the thin bar at the top, and depending on what are little better than four jewel screws and a brass cap to retain in position the whole of the accumulated motive power, and resist the effects of the wearer's hand in winding. The non-necessity of using this arrangement—which, however, secures the widest possible main-spring—is shown in the fact that it is never used to Swiss lever watches, which require stronger springs to propel them than horizontal ones; the width of the spring and its extra strength thereby being sacrificed to secure the efficiency resulting from a bottom bar support for the strong lever main-spring and its connections. The replacing of the centre pinion is often necessitated by breakage of its leaves from failure of the main-spring attachments; and its replacement is not a very difficult job. Usually, it may be taken for granted, a pinion the same size will be correct, but if the barrel teeth exhibit signs of wear a variation in the size and shape of pinion may be effected to improve or neutralise injurious action on the teeth. Before working-in the pinion a considerable reduction of its length is desirable to fit the set-hands arbor, as, if left too small when finished, the hole cannot be opened without injuring the pinion, and, perhaps, destroying it, and if opened enough when full-length, it may be too large when pivots are made right length. A safe plan will be to shorten the bottom pivot to nearly right length, leaving the top pivot double length, and opening from the top; the arbor will fit tighter as the pivot is shortened. An arbor of very good quality is necessary to turn the pinion on, and both pivots should be turned without removing the arbor, the ferrule only being shifted, or the pinion will not revolve truly. The amount of finish on the pivots will depend on the skill of the workman as a pivoter; a high-class hollow-centre pinion being reckoned one of the best tests of a pivoter's skill and taste, though a very simple job as usually found in ordinary Swiss watches. Most jobbers err in leaving too much rivet; just level with the brass will do well enough, and both wheel seat and rivet being well turned, a light blow at each bar with the hammer on a hollow punch that fits over the shoulder with a little side shake, and covers all the rivet, should complete the job. The callipers and toucher must be used to detect where the wheel is not true, and the punch inclined on the rivet in the direction in which it is desired to drive the wheel whilst riveting. Success depends on celerity in riveting, and much punching and bending will destroy the truth of the wheel. The pinion rivet should be fitted to the old recesses in the wheel without reopening with a broach. The pivot should project through plate and bar sufficient to keep the set square cup free of the bar, and in making the length of bottom pivot, the same rule applies for keeping the cannon pinion free of the plate; though, sometimes, an extra long pivot is left, and as the action of the minute wheel in the cannon pinion depends on the pivot, as it forms a shoulder against which the pinion rests, the requirements of the motion work must be studied when finishing the bottom pivot, and the various parts and height of the old pinion must be gauged and applied with a douzieme gauge as the work progresses; alterations, except of length of pivots and height of wheel, cannot well be made, as the work approaches completion. The necessary freedoms are indicated by the requirements of the barrel and centre bar, and the action of the wheel in the third pinion, and its position in relation to the balance and hair spring.

Some general directions for turning and finishing the steel work of watches may, we think, find a suitable place here, as the plans are the same for all pieces, with such modifications as the circumstances require. As a rule, jobbers are not handy at turning new pieces as they should be, and where practice has been neglected in early youth, it is not so easy to acquire facility enough to make it profitable, and so this part is relegated to makers of new works, or those who make a speciality of it. But there is a great pleasure to many workmen involved in putting in a new piece even if it can be put out more profitably, and I have known many jobbers who have imitated the finish on the work to match the watch to which it is applied, and if a piece of brass, the colour of the gilding has been a matter of careful study and practice with them, and only the men who do such jobbing know that a job has been executed on the watch, whilst every botch and tinker leaves his mark for all time on every bit of work to which he puts his hand, and the degradation of the character of every repairer or cleaner of the work afterwards follows as a matter of course. The first thing to secure success in turning is a good Arkansas oil-stone; a small handy size is a piece about 6 or 8 inches long, and 2½ broad; this should be kept perfectly flat by grinding on a paving stone with sand, as it is not possible to do good turning with gravers whetted on an oilstone full of rucks and holes. A flat whetted graver will cut when one rounded will only glaze the steel it is applied to. The harder the steel to be turned the more acute must be the angles of the cutting faces of the graver, and all good turning must be done with the point of the graver, and the sides merely used for smoothing large surfaces. Putting the graver in the mouth after wiping the oil from it which is used in sharpening it, moistens the point and improves its cutting-power on steel, and prevents the particles of steel from flying into the turner's eyes. Two bows are necessary in turning, one strong to rough the work down, and another weaker to finish; and two gravers on the same principle may be used with advantage.

(*To be continued.*)

QUERIES AND ANSWERS.

An Old Subscriber (Liverpool). — To remove tarnish from gilt clock bezels, dead white silver work, etc.:—Dissolve one ounce of cyanide of potash in one quart of rain water; bottle it, and label it "poison." Place the work in an earthen vessel, pour sufficient of the cyanide solution on the work to cover it, and the tarnish will disappear in five minutes. Re-bottle the solution for future use.

A.B.—An 18 carat and 15 carat alloy that will produce a good colour after colouring—

18 carat: 3 parts copper, 3 silver, 18 gold.
15 ,, : 6 ,, ,, 3 ,, 15 ,,

Practical Goldworker.

WATCHES AT THE MELBOURNE INTERNATIONAL.

An official report of the awards to watch manufacturers represented at the above exhibition is not yet to hand; but from cablegrams we learn that a First Prize has been awarded to the *collective* exhibits of the Swiss watch manufacturers. The most successful individual exhibitor is again the American Watch Company, so that the verdict of the jury at Sydney has been confirmed in Melbourne. These are significant facts, and we hope that our manufacturers will not underrate the value of these triumphs in the Colonial market.

THE GOLDSMITHS' AND SILVERSMITHS' FREE TRADE ASSOCIATION.

Mr. EDWARD J. WATHERSTON presided at a meeting of the Goldsmiths' and Silversmiths' Free Trade Association held on Saturday at 12, Pall Mall East, at which the following resolutions were adopted:—

1. That the report of the Select Committee on Hall-marking (1879) with reference to the principle of compulsory hall-marking having been adopted by a majority only of one —the minority including Mr. Goschen, Mr. L. Courtney, and Mr. Campbell Bannerman, three members of the present Liberal Administration, together with Mr. Muntz, M.P., Mr. Hankey, and other influential Members of Parliament—any legislation affecting the trades in the precious metals should be upon the lines of Mr. Hankey's draft report, which recommended the abolition of the duties upon gold and silver plate, and the abolition of the system of compulsory hall-marking and providing for a system of voluntary hall-marking of all gold and silver wares, under new and improved regulations.

2. That the Goldsmiths' Company not being a body in any way representing the interests of the trade, and being distinctly a Tory corporation, ought not to be consulted by the Government upon any proposed free trade legislation.

3. That, irrespective of the supposed interests of the trade, the fact of the depreciation in the price of silver and the fall in the value of the Indian rupee, present national interests in favour of encouraging by free trade legislation, the consumption of silver for manufacturing purposes.

4. That the thanks of this association are due to Mr. Edward J. Watherston, for his persevering efforts to reform the laws affecting the trades in precious metals.

THE GOLDSMITHS AND THEIR DISCIPLINE.

Recent proceedings instituted by the Goldsmiths' Company against transgressors of those privileges of theirs which, to its great advantage, they hold in trust for the public, render it of some interest to cull from the records of this most ancient and honourable City guild, certain instances of their administration of penal justice when they held its infliction in their own hands.

In 1452, German Lyas offended in many ways, but particularly by selling a tablet of gold which was dishonestly wrought, being two parts of silver. Lyas was contumacious, and would neither appear at the commandment of the wardens nor produce the tablet. He was taken and brought before "the worthy members of the fellowship." The wardens, after deliberation, awarded that he should give to the fraternity a gilt cup of twenty-four ounces weight, and "lowly abase himself upon his knees." This being done, he was pardoned and reinstated.

In 1530 John Carswell, having made and sold some sadly adulterated salt-cellars, was brought to the Goldsmiths' Hall at eight o'clock in the morning, and there set openly in the stocks. There he remained until after dinner-time, when he was brought into the parlours before the wardens, the assistants, and the livery, and asked how many such salts he had made; whereupon he confessed that he had made over a dozen. It was then demanded of him what recompense he could make to those who had bought the said salts. He answered that he had not wherewith to recompense them. Whereupon the wardens, with the advice of all the fellowship, commanded that he should be had to Newgate. This was done, there to remain till his acts were better examined. But death anticipated the further action of his guild, and the offending craftsman breathed his last in the prison.—*City Press.*

LECTURES ON WATCH AND CLOCK MAKING,

PREPARATORY FOR THE ELEMENTARY EXAMINATION OF THE CITY AND GUILDS OF LONDON INSTITUTE IN MAY, 1881.

Delivered at St. Thomas Charterhouse School by I. Herrmann, on Monday Evenings from October 25th.*

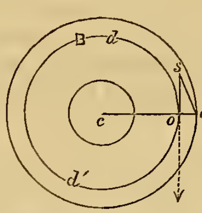
(*Continued from page* 99.)

In fig. 15 we have represented purposely, a somewhat extreme condition of the position of the mainspring, when wound, to show more clearly the principle and application of a power acting obliquely. Practically, in a barrel with its parts in proportion, viz., spring one-third (when down), space one-third, and arbor one-third, the direction of the last turn, when wound up, would not make so small an angle with the radius drawn to the hook as 30 deg. Though the mainspring occupies one-third of the barrel when down, measured in relation to the diameter or radius, when wound up its outer turn will be further from the centre than two-thirds; that is, the outer turn, when wound up, will not take up the position of the inner turn when down, because as the spring is coiled in smaller circles their number increases.

Thus for a barrel with an inside radius of its rim = 1, and radius of its inner coil (when down) = ·666, the radius of the outside coil, when wound up, would be ·816.†

We will confine ourselves to two arrangements, by which the principle of "virtual lever" has been used for the purpose of equalising the effect of the mainspring.

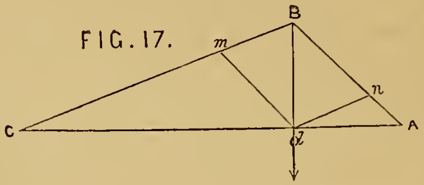
FIG. 16.



Let B, fig. 16, represent a barrel, *c* its centre, and *d d′* the spring and arbor when it is wound up; *s a* is a piece of steel of the same breadth as the mainspring, and sufficiently thick as not to be bent up by the force of the spring. It is movable about *a*, where it rests against a step in the inner rim of the barrel. The other end *s* has the mainspring attached, either by a rivet or hook. When the spring is down *a s* fits close up to the rim of the barrel, or sometimes into a recess, and when wound up it takes up the position shown in fig. 16. Since *c o* is perpendicular to the direction of the mainspring, that is the outside coil, here representing the direction of the force, it is evident, as shown in fig. 15, that *c o* is the virtual lever arm; hence we have the same condition thus far, as if the spring was hooked in the ordinary way.

Still this arrangement does equalise the force of the spring, which, however, results from another principle which enters into the calculation.

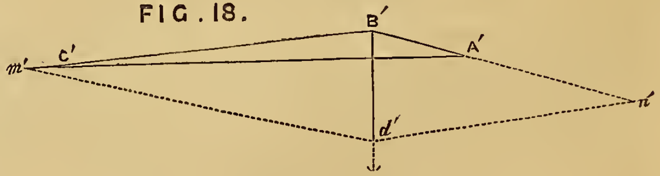
FIG. 17.



Let C, fig. 17, represent the centre of the barrel, A the point in its rim against which B A (*s a*, fig. 16) is resting, and about which it is movable. Let B represent the point where the mainspring is attached to B A, and let the spring be wound up close, so that B is brought in contact with the next coil of the spring whose radius is B C. Let B *d* represent the pull of the mainspring in magnitude and direction, and draw *d m* parallel to A B, and *d n* parallel to C B, then B *d* is resolved into two forces, B *n* and B *m* respectively. B *n* represents the pressure on A, and B *m* on C. It is this pressure on B which equalises the force of the spring; the turns are forced together, and thus friction forms the compensating element.*

Friction is proportional to pressure, and the pressure is regulated by the length of B A.

FIG. 18.



Let fig. 18 represent this condition, that is, all proportions as in fig. 17, except B′ A′, shortened so that $\angle$s B′ A′ C′ and B′ C′ A′, become more acute, and C′ B′ A′ more obtuse. If we resolve B′ *d′* parallel to B′ A′ and B′ C′ respectively, then B′ *n′* represents the pressure on A′ and B′ *m′* on C. Hence it follows that in proportion as B′A′ and B′ C′ approximate to a straight line, have we the turns of the mainspring forced together, and when the $\angle$s B′ C′ A and B′ A′ C are very small, the spring is held in equilibrium by the pressure B′ *m′*. It is clear then, that the compensation or equalising of force is effected by friction, which is a very uncertain and therefore an objectionable and impracticable method.

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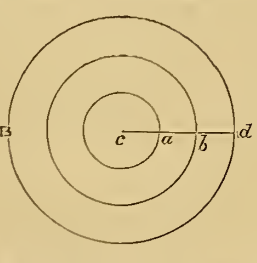
* All rights reserved.

† Let B represent a barrel, *c* its centre, *c d* the radius of the inner rim = 1; *c a* the radius of the barrel arbor = ·333; *b d* the space occupied by the mainspring = ·333, and *a b* the space between the arbor and spring = ·333. Required to know the radius of the outer coil when the spring is wound up, or the virtual lever arm. Let the virtual arm = x, then



$$(\cdot 333 + x) \times (x - \cdot 333) \times \cdot 7854 = (\cdot 666 + 1) \times (1 - \cdot 666) \times \cdot 7854$$

$$(x^2 - 333^2) \times \cdot 7854 = (1 - 666^2) \times \cdot 7854$$

$$x^2 - 333^2 = \cdot 5564$$

$$x^2 = \cdot 5564 + \cdot 333^2$$

$$x = \sqrt{\cdot 5564 + 333^2}$$

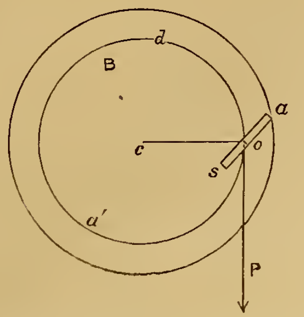
$$= \sqrt{\cdot 667289}$$

$$= \cdot 816.$$

* The reader should study the article on "Friction" in connection with this section.

The other arrangement we have to consider is shown in fig. 19.

FIG. 19.



Let B represent a barrel, *d d′* the mainspring wound up; *a s* represents slots in the barrel and cover, both being parallel. The end of the spring is fixed to an arbor, which extends, or has two pivots on each side of the spring, so that one moves in the slot in the barrel cover, and the other in the barrel bottom. These pivots are represented in plane at *o*, and *o* P shows the direction of the pull of the spring.

A brief inspection of fig. 19 will make it apparent that these slots introduce a new principle, viz., the inclined plane.

This arrangement is identical with that shown in fig. 16 as regards effect, that is, the force is equalised by friction; but this effect is produced by the inclination of *a o* to *c o*. If *c a o* approximates to a right angle, the force of the spring would be kept in equilibrium by pressure, as shown in fig. 18, and again as *a o* approximates to a straight line with *c o*, the pivot *o* would refuse to move from *a* towards *s*, and we should then have only the same condition as the ordinary French or English hook. In order then, to understand these conditions it is necessary to make ourselves acquainted with friction, the inclined plane, and movable inclined plane, or wedge.

Friction.

The term "Reaction" has a special place in the principles we have to consider, therefore it will be well to ascertain the idea it represents. This is expressed in the third of the three mechanical axioms called "Newton's Laws of Motion." Since they form the fundamental principles of all mechanical problems, it will be well to quote them now:—

1st. "Every body continues in a state of rest, or of uniform motion in a straight line, except in so far as it may be compelled to change that state by force acting on it."

2nd. "Change of motion is proportional to the acting force, and takes place in the direction of the straight line in which the force acts."

3rd. "To every action there is always an equal and contrary re-action; or the mutual actions of any two bodies are always equal, and oppositely directed in the same straight line."

The term "reaction" implies that if two bodies are in contact and exerting any pressure, each body will be reimpressed, proportioned or equal to the force with which it is urged against the opposing body. If a body, whose weight is 10 pounds, is resting on a table, it is reimpressed to the same extent by the table.

This fact plays an important part in "friction", for the effect is proportional to pressure, and since in any two bodies in contact the pressure on their sufaces is equal, it follows that (difference of material excepted) the friction on both must be equal.

The laws or principles relating to friction are generally stated thus—

(1) Friction is proportional to normal pressure.

(2) It is independent of the extent of the surfaces in contact.

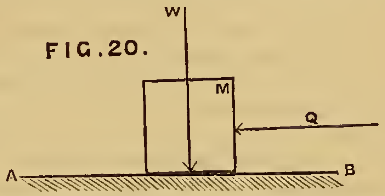
(3) In case of motion, it is independent of velocity.

(4) If unguents are interposed so as to form a continuous stratum between the surfaces of contact, the friction depends mainly on the nature and quality of the lubricant.

Friction therefore is measured by the resistance a body offers when a force is applied to set it in motion. This resistance is due to pressure, and the nature of the surfaces in contact.

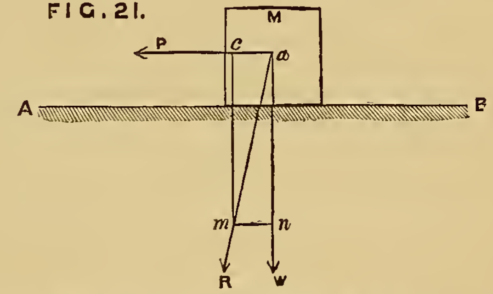
This resistance is represented in magnitude by the ratio it forms to the pressure of contact, or normal pressure of the mass to be moved, or, secondly, by the angle at which a force has to be applied with the normal to make it slide.

FIG. 20.



Let M, fig. 20, represent a mass of one unit resting on a table A B, and let W represent the normal or vertical pressure on A B. A force Q is applied parallel to the plane of the table, the ratio that this force bears to the mass M bordering on motion is termed coefficient of friction; it is the sum a mass has to be multiplied by, when the nature of the surfaces in contact is given to find the force necessary just not to make it move.

FIG. 21.



Again, let M, fig. 21, be a mass resting on a horizontal table A B, let a force P be applied at *a*, and let *a o* represent its magnitude, also let *a n* represent the normal pressure of M. Complete the parallelogram *a o m n*; then the force R, necessary to move M when applied at *a*, is represented by the resultant *a m*, and ∠ *m a n* is called the limiting angle of resistance or angle of friction.

Tables have been constructed giving both the coefficient and angle for different materials.

Thus it is found that—

		Coefficient.	Angle.
Brass and steel or iron	gives	0·142	8°
Soft steel and soft steel	,,	0·147	8° 15′
Cast iron and steel	,,	0·150	8° 30′
Hard brass and cast iron	,,	0·167	9° 15′
Brass and brass	,,	0·175	10°

These ratios will be considerably modified when a lubricant is introduced, of which we will take note when we consider their application.*

(*To be continued.*)

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* If the angle formed by the surfaces of a pin, or the inclination of a screw is greater than this limiting angle of resistance, the pin or screw will not hold. Hence we see that without friction the present method of fixing the sections of a watch together would not be practicable.

WATCHMAKING.

On the three Mondays of February 7, 14, and 21, Mr. Edward Rigg, M.A., delivered at the Society of Arts, in the Adelphi, the three Cantor Lectures upon Watchmaking. The wretched state of the weather no doubt had a deterrent effect on the general members of the Society, but the horological element mustered in considerable numbers, and helped to constitute what would otherwise have been a rather dispiriting audience. The lecture table was well supplied with models and watches of various styles of construction, whilst the walls were made intelligent by numerous and well executed plans, diagrams, and sketches, all illustrative of the subject to be dealt with. These were on a large scale, some two feet in diameter, and were easily comprehensible from every part of the theatre.

I.—The following was the Syllabus of the course.—Introduction; units of time; historical sketch; description of the usual forms of watch escapements; conditions of accurate timekeeping, and arrangements necessary for their maintenance in the higher class of watch.

II.—The ordinary watch; degree of accuracy required in it; systems of manufacture in this country and abroad; description of specimens illustrative of the various stages of construction; comparison of the several systems.

III.—Necessity of efforts to promote the art in this country; need of education, theoretical and practical, in horology; literature; great want of uniformity in gauges, screws, &c.; exhibition of ordinary and complicated watches, and of watchmakers' tools; conclusion.

The different watches in motion were thrown upon the screen enlarged to from 12 to 18 inches in diameter of a lamp that was called by the wonderfully up-in-the-clouds name of the "Aphengiscope, and the electric light." As it is utterly impossible with the limited space available in this Journal, notwithstanding its recent enlargement, to give anything in the shape of a report *in extenso* of these lectures, we will do the best we can by means of a condensed abstract of the more important points. For this reason, too, we have reproduced the Syllabus, so that the reader may know the whole of the ground that was gone over on the occasion.

The first part touched upon was the poverty of horological literature in England as compared with what is done in that way in France and Switzerland. That is an old complaint, and the lecturer did well to reiterate it. The late Mr. Charles Frodsham, than whom no better authority then lived, stated in his "Elements," published as far back as 1862:—"One of the most important facts in the advancement of every art or science is the knowledge of its literature. There are many valuable books on horology which, though not up to the last idea, are at least valuable beacons to avoid the waste of time in making researches already known; and the student, instead of trusting to the resources of his own single mind, must ransack a thousand minds, and thus make use of the accumulated wisdom and experience of ages, so that he may take his point of departure from the last line and boundary to which science has advanced. I refer to this point the more strongly from what I daily witness in the failure of almost a lifetime spent upon abandoned mines of invention arising from this very want of knowledge, &c." He says that at the International Exhibition many old schemes were presented as new, their authors being apparently in perfect ignorance that such schemes had been long rejected as valueless, which ignorance could not have existed if horological literature had been properly cultivated. If it had occurred to him he would have added that the difficulty of persuading the great body of working watchmakers to look upon a knowledge of the literature of their trade as necessary to their advancement is not encouraging in that direction. Still it moves upwards, though slowly, to what could be desired. Commenting upon the national aspect of the question, the lecturer said that by a comparison of the methods of manufacture adopted at the several centres of watch industry he would endeavour to ascertain whether changes in that direction could be introduced with advantage for the benefit of England, not only in respect to the security of our unsurpassed position in the production of high-class instruments, but also with respect to an increase of business in cheaper markets. He referred to the fact that France, Switzerland, Germany, and America had shown a marked advance, whilst England had at best remained almost stationary. In supplying the marine chronometer to the navies of the world England still held her own, and statistics of the trade in every country were here gone into.

The lecturer next gave an outline of the history of timekeeping instruments from the Roman period downwards. In later times the inventions and discoveries of the great luminaries, from Galileo, Huyghens, Hooke, Sully, Graham, Harrison, Le Roy, and Mudge, to Earnshaw and Arnold, were explained. After dealing with escapements he concluded that many watchmakers had missed the real points at issue as between the going barrel and the fusee, and that the advocates on both sides had certain correct views of that part of the question. The well-known compensating gain on the loss in 24 hours was adverted to, and he stated that the motive force with the going-barrel was less constant than with the fusee, and that more skill was required to adjust the former than the latter.

M. Philippe's experiments were alluded to, in which the going-barrel variation in the arc of vibration ranges from 112 to 65 degrees in twenty-four hours, according to the form of mainspring and the way in which it was fixed in the barrel. He held that timing for position was very much neglected, instancing the difference between the flat and the upright, and that where the motive power is not uniform the adjustment becomes almost impossible. The additional cost of a fusee was so slight as not to be worth considering, and if it is abandoned additional care and skill, consequent on the increased risk of derangement in the cleaning, etc., will keep it out of any but the most skilled hands. Those remarks referred only to the highest class of instruments, but whether the fusee should be retained in watches to compete with foreign produce involved other considerations.

The opinion of M. Henri Robert, a strong advocate of the going-barrel, was to the effect that the fusee should be retained in all high-class watches; and he was far from being alone in the matter, as many of the best Continental authorities were of the same way of thinking. The mainspring of a fusee train, besides equalizing the motive force, could be made so as to prevent a "choke" on the arbor by tight winding. That was done by tapering the spring from within outwards, which would cause the coils to separate from the first movement of the barrel. Such a spring, he held, could not be used in a going-barrel, since the variation in force was greater than with a fusee. M. Philippe's experiments were stated to have brought out that fact, thereby establishing the correcting action of the fusee. Many changes had been suggested, both in mainspring and escapement to overcome the great variation in the going barrel, but none of them had been absolutely successful as compared with a well-constructed fusee and chain. The lecturer next mentioned the high degree of perfection that had been attained in watches, even to half a second in twenty-four hours, which was a near approach to what was within the bounds of possibility.

Future advance in the trade could only be looked for by two possible avenues—a more general distribution of high-class timekeepers, and a simplification of manufacture so as to lower the cost; and he called for a properly constituted authority for testing all watches offered in the same way that chronometers were tested at Greenwich, and thermometers at

Kew. By such means great progress had been made in accuracy by Continental horologists, as was borne out by the testimony of Dr. Hirsch, of the Neuchatel Observatory, Switzerland. This concluded the first lecture.

The second lecture dealt with the cost of English and foreign watches; the three systems of manufacture; the advantages of machine-made watches; disadvantages of the hand system, and practical suggestions.

The lecturer began by calling attention to what had been already said by him, and went on to remark that the rapid increase of production of the watch in the Continental centres and the United States, and the improvements in the going barrel, made it incumbent on the English trade to take note of that, and strictly investigate their own system of manufacture with a view to its practical improvement. He next referred to some statistics to show the rapidly increased demand for a medium and cheaper class of watch by the large number imported and sold here. The mean price of French clocks and watches had considerably fallen since 1867.

In the years embraced between 1867 and 1870 the fall in the price of watches was from £6 17s., in 1867, to £4 17s. in 1871. The mean average price of the English watch for the same period was £5 8s., and that of the foreign about £2 17s. We prefer giving the nearest approximation in shillings, as the lecturer only gave decimals of a pound. These figures pointed to the unsatisfactory condition of the trade until such a difference was justified or the price reduced.

With respect to manufacture, it was evident that the changes in recent years had brought machine tools more and more into use, and had thus tended towards the introduction of the factory system in the place of what was essentially a home manufacture. Three systems were at present in existence. These were—(1) workmen at special trades having many employers; (2) workmen in all the trades being in one large factory; and (3) a combination of these two plans, which the audience perfectly understood. He next dwelt upon the value of a practical knowledge of tool-making, and the little that was known in the trade of the tools that were used in machine watchmaking factories. By the kindness of many manufacturers in London, Coventry, Prescot, and Birmingham, he had been enabled to examine the machinery now in use, and dwelt upon its accuracy and beauty of finish. He mentioned the Messrs. Rotherham, of Coventry, as having a series of shops devoted to tool making, which is perfectly correct. We were somewhat disappointed at finding that the above firm was the only one that we heard named, the more especially as the English Watch Company of Birmingham are known to have an engineer's shop, fitted with every requisite appliance for the construction of all the mache-tools—some of them of a most complicated character—which they use. We have no further concern with the omission here than to notice it. The lecturer then showed a number of specimens illustrative of the various stages of both machine-made and hand work, by means of the electric light. The display of the several pieces on the screen made the illusion so perfect that the spectator could scarcely believe his eyes that he was not looking upon solid work fixed against the wall. The audience signified their approval of this by hearty applause.

In the advantages presented by machine-made watches, some work was shown for uniformity in make and reduction in cost, for the ordinary quality. For high-class watches the question must be left to horologists themselves, as he disclaimed any desire to dictate to them, but to urge reforms in the art, and to see the points where advice might be taken from our neighbours.

The clock trade as an industry was practically dead (except as regarded turret, chime, and regulators). The reason why might be waived, and a passage from the address of Mr. Bramwell, the Chairman of the Council of the Society of Arts, was quoted:—"We now find, it may be, that many of our industries are carried on according to the old traditions, traditions and practices which were best known in the days they were first employed, but which under the marching of science in other countries have been abandoned as obsolete, while they are retained by ourselves." If the English system was not adapted to the production of a cheaper class of watch it might be asked, What was the remedy?

With respect to the disadvantages of the English system, it must be admitted that it was not calculated to encourage radical improvements. The workman by hand was usually only acquainted with a small proportion of the details, and, therefore, in an unfavourable position as an inventor; the jobber, on the other hand, stood a far better chance, because he had the complete watch before him, and was able to thoroughly make himself master of all its details, faults included, and could thereby see where improvements might be made. The distribution of the making of a watch caused much needless expense—in many instances, double work—and the avoidance of that would be the employment of machinery to the most practicable extent. The factory system would not be welcomed in Clerkenwell, but, as it had existed so long, perhaps the best way would be to try and improve it. He would let Prescot keep the movement-making, Coventry the case-making, in addition to its other share of the trade, and Clerkenwell the finishing, escape-making, etc.; but if the trade was to continue a trade the several branches must work more into each other's hands. It was absurd that one man should be called upon to undo the work of his predecessor, when by proper organisation all that might be avoided. In a watch factory all work of one kind was made according to a templet, and therefore all pieces were alike. It was surprising that templets were not much more extensively used. If an accurate system of standard gauges were in use, the Clerkenwell workman might take up the Prescot movement where that maker left it off, without having to do any part of it over again.

A few words about small establishments. The principal feature which stood in the way of any material change was the great number of these that had to be kept up in Clerkenwell. They not only increased the cost, impeded improvements, but they produced delay. Many of them, too, were utterly unfit for occupation, and deteriorated the character of the workman and the quality and quantity of his work. Mr. Glasgow had suggested the practicability of having one or more large shops in Clerkenwell, where all branches of the trade could rent what space each required, and thus be in contact with each other. Furthermore, steam power might be let to those whose work required it.

The third and concluding lecture began by a statement that although watchmaking was an art in the highest sense of the term, yet it had been sadly neglected by men of science. Its truths had not been arrived at by scientific reasoning, but by pure observation and experiment. In the form of the teeth of wheels—the cycloidal and involute—the former was not always believed in, although proved to be the best by mathematical investigation more than a century ago. There was no good evidence of an advance being made, the trade was in a decaying state, and even manual skill was often wanting, owing to the failure of the old apprenticeship system. We must either take energetic steps to provide theoretical and practical instruction to the young workman, or the quality of the best English work must deteriorate. The lecturer then referred to the efforts made on the Continent for first-class watch education, congratulated his hearers on having the British Horological Institute in union with the City of London and Guilds Institute, from which a theoretical and practical school of horology had arisen, and which it was to be hoped would be eagerly taken advantage of. He passed a warm eulogium on the Horological Institute having, in the face of a long depression of trade, erected a most commodious building for its members. He recommended Saunier's "Treatise on Modern Horology," as it was a text-book all over the Continent.

The various systems of measurement were next adverted to, and it was stated that such an important question would have to receive a large share of attention. The late Charles Frodsham had re-discovered the Lancashire gauge, and had explained the excessive cost which its use entailed. We are quite in agreement with the lecturer on this point. Mr. Frodsham had a great deal of trouble to unravel its meaning, for some of the oldest men in the trade in his day had always treated it as a tool without regard to any standard of measurement whatever. "This gauge was a three-inch rule subdivided duodecimally. A watch whose movement was one inch in diameter was said to be 0 size, and the second inch was subdivided into thirty equal parts or sizes, so that each size was $\frac{1}{30}$ of an inch. The various heights of pillars were also very numerous and unnecessarily minute, each gradation in height being equal to $\frac{1}{144}$ part of an inch only. What necessity, however, can there be for so large a number of sizes, which now differ only 0·033 of an inch, that is three sizes to the tenth of an inch?" . . . "Surely one tenth of an inch is a difference small enough between one watch and another to meet the taste of fashion, and certainly quite equal to all the requirements of horological science."

We are sorry to say that the late Mr. Charles Frodsham's "Few Facts Connected with the Elements of Watch and Clockmaking" are out of print, as the book, small as it is, contains an immense amount of valuable, reliable information. It would be well worth reprinting by subscription throughout the trade.

The lecturer recommended a conformation to what was being done by the Society of Arts of Geneva in the reports upon gauges and screw threads, as it showed what efforts were being made in that direction.

The attention of the audience was next directed to a large collection of beautifully made tools which had been lent by Messrs. Grimshaw and Baxter. There were also some finely constructed universal lathes by Mr. G. Boley, of Esslingen, in Wurtemberg. The lecturer demonstrated their action, and said that they had been very highly spoken of in the Continental horological journals. In coming to a conclusion, Mr. Rigg acknowledged the liberal assistance which he had received from many members of the trade, and he directed attention to the elaborate series of diagrams which had been specially prepared by Mr. S. G. Willmott. He also expressed his obligations to Dr. Longton, of Southport. A large number of the complicated watches, such as several forms of keyless work, repeaters, clock, musical, and calender watches.

There were many reasons why reforms in watchmaking would now stand a good chance of being successful. Technical education was improving, whilst foreign competition was forcing more attention to the question. It was for our prominent horologists to jointly consider the many questions that need solution, such as the caliper, the gauges, and the system of manufacture. A marked improvement in the near future might be confidently looked for, and the cheaper class of English watch might compete with some chance of success with those of foreign construction—at any rate in our own country.

The various specimens both of machine and hand manufacture were exhibited by means of the hard-named light already alluded to on the screen, and they actually looked so real, although so much enlarged, that the spectator could not only see the colours of the metals exactly as they were in the watch itself, but the thickness and thinness, and length and breadth of everything! The dials were off some of the repeaters and chronographs, and nothing could appear more perfect; even the jewelling and the screws of the balances were quite plain. Mr. Tripplin, Bartlett's Buildings, Holborn, supplied several watches, and one, a keyless minute repeater, came in for a large share of applause, as its hammers could be seen beautifully illustrating its peculiar action. If the sound of the gong-wires could have been "reflected" in proportion to that of the mechanism itself, what a deafening "row" there would have been!

The English Watch Company, of Birmingham, furnished a complete collection of their machine-made work in various stages of construction and finish, and which came in for a good share of attention.

We must not omit to state that Messrs. Lund and Bleckley, of Pall Mall, lent a very fine calendar watch, which was exhibited.

Mr. David Glasgow proposed a vote of thanks to the lecturer on behalf of the watchmakers present. His answer as to why they in Clerkenwell did not adopt the Continental system was—because they did not believe in it. The fusee was the best form, and, notwithstanding what had been said, they would "stick" to it.

The chairman seconded the vote, and in alluding to Mr. Glasgow's determination to "stick" to the fusee, said that it was being pushed out of the Colonial markets, and he thought that it behoved all of them to watch what their opponents were doing.

The vote having been carried with acclamation, Mr. Rigg replied, and the interesting proceeding were brought to a close.

Tracing the Pendulum.—At the last session of the American Association, Professor Mayer said: Last year, in the month of October, I mounted in the physical laboratory of the Stevens Institute of Technology a Foucalt pendulum, formed of a cannon ball, suspended by a steel wire. By floating the ball in mercury, I determined the point on the ball to which the wire should be attached, so that this point and the centre of gravity of the ball should be in the same vertical line. This line, having been prolonged as a diameter of the ball, determined the spot into which I screwed a pointed index. The point of this index, when the ball was stationary, was about $\frac{1}{40}$ of an inch above a piece of smoked paper, placed on a plate of metal which had been carefully brought into a horizontal plane. The pendulum was now drawn from the vertical by the tension of a delicate cord, one end of which was attached to the ball, the other fastened to a fixed support. The pendulum was started, in the usual manner, by burning this string. After a few oscillations a current of electric sparks from an induction coil was passed through the suspending wire, and from the point of the index of the pendulum through the smoked paper to the metal plate, and thus was obtained a trace of the path of oscillation of the pendulum. At successive and known intervals of time I obtained similar traces, which were rendered permanent by passing the smoked paper through spirit varnish. Last May I described this experiment to Professor Cross, of the Massachusetts Institute of Technology, and he then informed me that the same idea had occurred to him, though he had not put it in practice, and also that he had recently mentioned this plan of experimenting before the American Academy of Arts and Sciences in Boston; therefore his name and mine should be always associated in designating this method of obtaining a permanent trace from the Foucalt pendulum.

Pretty new bracelets are of white kid, painted by hand and mounted with gold.

Pretty bangle rings have stars of crescents, studded with small turquoises as pendants.

HALL-MARKING.

ADDITIONAL attention will, in all probability, be drawn to the vexed question of hall-marking plate by the failure of the prosecution against two persons who were lately charged at the Central Criminal Court with counterfeiting certain marks or dies used by the Company of Goldsmiths in London for stamping gold plate. In the case of the first defendant, who was described as an engraver, the principal witness for the Crown was a commercial traveller, who deposed that, having met the defendant at a tavern in Clerkenwell, he was shown by him several "keeper" rings purporting to be hall-marked. One of these rings the witness purchased, for the certainly not extravagant sum of one shilling and threepence. The next day he took the ring to Goldsmiths' Hall. A few days afterwards the witness, who appears to have obtained the defendant's address on the representation of doing business with him, went to his house in Upper Street, Islington, and was shown several more rings, some in a finished, and others in an unfinished state. In the witness's presence, the defendant punched what purported to be "hall-marks" on the inside of four rings, and polished them. The rings were then sent to the gilders. On their completion the witness paid seven-and-sixpence, and took them to Goldsmiths' Hall. The Company eventually instituted the present prosecution. The defence was, in effect, that the marks fabricated by the defendant were not imitations of the genuine hall-mark of the Worshipful Company of Goldsmiths, but that they differed from it in many important particulars; and it was asked, with some pertinence, why no proceedings had been taken against certain manufacturers of electro-plate in the provinces and elsewhere who habitually affix certain marks to their wares. This question, however, is open to the obvious reply that such stamps are only of the nature of trade marks, and that they do not bear a colourable resemblance to the marks imprinted on plate at Goldsmiths' Hall. Nor, in the opinion of the jury at the Old Bailey, were the marks punched on the fifteenpenny gold rings fraudulent imitations of the genuine cognisance of Goldsmiths' Hall. They acquitted the defendant, and a similar verdict was also given in the case of a second defendant, a clockmaker, who was indicted for the same offence.

Almost concurrently with this unsuccessful prosecution Sir David Wedderburn, in the House of Commons, was asking the Chancellor of the Exchequer a question bearing with equal directness on a certainly interesting social question. Had the attention of the Government, asked the honourable baronet, been directed to the fact that an important native industry in India was hampered by the import duty levied on all silver ware imported into the United Kingdom; and was there any intention of considering the question of abolishing the said duty? Mr. Gladstone replied that the matter was not one of great financial importance, but that he had carefully considered the subject of the duties imposed on silver ware imported from India into the United Kingdom, and that he should continue that consideration, in the hope that circumstances might in a short time enable him to make some proposal to the House. This, to a certain extent, may be regarded as a satisfactory assurance; but it would be even more gratifying if the Government would speedily take into exhaustive consideration the whole question of the production and the taxation of home-made plate. With respect to hall-marking we fail to see why gold of a high standard—that is to say, from eighteen carats upwards—should not have its exceptional purity recognised and protected by some official stamp or mark; but we are equally unable to see why the Worshipful Company of Goldsmiths should longer retain the exclusive privilege of stamping merchandise which in a vast number of instances is made by persons who are not in any way affiliated to this particular City Guild. It may be granted that the privilege is a very ancient one; since, by the statute 15 Henry VIII., it was ordered that no goldsmith within or without the City should thenceforth put to sale such description of plate in any of the places mentioned unless it had the mark of "ye Lybards hede," or leopard's head, crowned. All plate offered for sale contrary to these regulations the wardens were empowered to break. The ordinances of the Company afterwards provided that at certain stated periods of the year, notably on the occasions of Bartholomew, Southwark, and Lady Fairs, the City and the Borough were to be perambulated by the wardens and renter wardens, their livery with their hoods, the beadle in full costume with his insignia of office, together with brokers, porters, and attendants. The object of this solemn procession was to ascertain whether all the goldsmiths and silversmiths within their jurisdiction were making good and true ware, and also to make search for false weights. The search appears to have been conducted in manner similar to that employed by the "ale-conners" who periodically tested the quality of the beer and the quantity of the measures used in public buildings—proceedings resembling those which middle-aged people can yet remember to have seen in London when the "inquest" or "annoyance" jurors went their rounds, often resulting in the penal chopping up, "coram publico," of the deficient weights, the loaded scales, and the illegally diminished pewter pots and noggins of dishonest traders. The Goldsmiths' Perambulation went into Chepe "for to see what playte is in eny mannys dirk and gyrdyll." They were to "goo into Lumberd-streete or into other places where yt shal please theym." As for the beadle and the brokers, they were to wait upon the wardens and "see every hardware man's show for deceitful things, beads, gawds of beads, and other stuff;" and then they were "to drink, when they have done, where they please." The Goldsmiths' Company are no longer the teachers and the custodians of a particular craft and mystery, the possessors of a monopoly for its exercise, nor the censors of what is good in goldsmiths' work. They are simply empowered to assay gold and silver ware, and to hall-mark it according to its intrinsic value. Such assay and such marking—equivalent to the French "contrôle"—could at present be done much more economically by the Government. The present hall-mark is of a fantastically varied and almost cabalistic character, and the different punches of the leopard's head—for London—the "duty mark," or head of the reigning Sovereign, and the "date" and manufacturers' marks not only are confusing and irritating to the purchaser, who is entitled to find on the face of his purchase a plain statement of its standard, but lend themselves to the multiplication of more or less colourable imitations of the genuine mark, not merely puerile, but, in some cases, directly fraudulent. The Goldsmiths' Company, no doubt, do their duty according to their lights, to the best of their ability; but it cannot be too widely known that this country has got a very bad name among the nations of the Continent for the inferiority of gold employed in mounting jewellery. Most of our watch-cases are, indeed, of standard gold, and the gold also of wedding rings is usually unimpeachable in its purity; but the contemptuous verdict passed by foreign assayers on English "jewellers' gold" is generally summed up in the words "bas or." How can this be wondered at, when the Goldsmiths' Company will hall-mark gold of less than ten carats intrinsic worth? In France the "contrôle" represents one uniform and high standard; and to counterfeit it means the galleys. A hall-mark, to our thinking, whether it be impressed by the State or by the Goldsmiths' Company, might most fitly consist of the symbol of the Imperial crown, with the fineness of the ware and the date of manufacture expressed beneath in small letters and numerals. Everybody would know what a crown and "18c." or "22c." stamped inside a ring or on the edge of a brooch meant; and to forge the crown mark should be made a felony, and its "colourable" imitation a misdemeanour.

One of the charges made against the goldsmiths in the time of the Tudors was that "daily divers straungers and other gentils" complained and were aggrieved that they came to the shops of goldsmiths, both within and without the City, and to their booths and fairs and markets, and there bought of them "old plate, new refreshed in gilding and burnishing," it appearing to them that such old plate was "new, sufficient, and able, whereby all such were deceived, to the great scandal and jeopardy of all the said craft of goldsmiths." It is the direct converse of this complaint which has been recently made by our "straungers and other gentils." Amateurs and collectors of old "orfèvrerie" have been aggrieved by the impudent dishonesty of unscrupulous dealers, who have foisted off on their customers as antique plate either silver ware manufactured in Clerkenwell the day before yesterday, so to speak, or bearing forged hall-marks, or else plate of no particular date or character, in the substance of which have been cunningly inserted strips of silver bearing genuine hall-marks of remote date cut out of pieces of smaller size, and consequently of less intrinsic value. This audacious fraud, which was in most cases perpetrated in connection with so-called "Queen Anne" ware, appears to have been systematically carried on, "to the great scandal and jeopardy" of the goldsmiths' craft, until very recently, when certain awkward exposures gave what it is to be hoped will prove a permanent check to a most nefarious practice. But the evil consequences of the disreputable course so extensively pursued have not by any means disappeared, amateurs being afraid to buy ostensibly antique plate lest they should be swindled. On the other hand, the manufacture of modern plate is in the first instance grievously burdened by the most oppressive and undiscriminating duties; and, in the next, the production of gold and silver ware is every year more and more discouraged by the tremendous competition of electro-plate. Birmingham and Sheffield are kings; and, although the Elkingtons may from time to time produce art-ware in chasing or "repoussé" worthily rivalling the productions of Benvenuto Cellini or Maso Fineguerra, it is not beauteous vases and ewers, shields and tankards, that the majority of the affluent community require. They want forks and spoons, fish and dessert knives, sugar tongs and salt cellars, cruet stands and side dishes; and in at least seventy-five instances out of a hundred, where the paraphernalia of the breakfast and the dinner table were formerly made of sterling silver, they are now made of electro-plated nickel. The silver plate manufactured, in short, is in the worst of ways; the goldsmith's art, in England, is dying out; and oppressive imposts deprive us of the enjoyment of tasteful examples of Oriental art in gold and silver ware. Truly the whole subject is worthy of the most thoughtful "consideration" on the part of the Chancellor of the Exchequer.—*The Daily Telegraph.*

BRONZES.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 44.)

SOME of the more extensive private collections of antique bronzes in Italy, in France, and in England have been dispersed within the last few years, and their important objects have been acquired by the public museums of Europe.

With the advance of the Christian religion, but not entirely consequent thereon, sculpture declined. Its greatest subjects were directly offensive to the Mosaic law, the spirit of which, as regards idolatry, was inherited and promulgated by the disciples of Christ. Paganism was moreover rotten at the heart, and the grand old poetic spirit which had fed and developed classical mythology, crushed by despotism and scorned by philosophy and materialism, had faded away, leaving as its record the beautiful forms in which it had been so sublimely embodied. These, however, still afforded a standard about which priestcraft clung, which interest fostered, and to which ignorance still looked for aid. But among nations of Grecian, of Etruscan, and of Latin blood, the æsthetic and artistic desire was inherent, and could not entirely perish; eventually its direction was altered and its application modified. Meanwhile, the wreck of the Roman dominion, the inroads of barbarian hordes, and finally the removal of the seat of empire to Byzantium, had throughout and rapidly undermined and debased the spirit of that wondrous creative faculty which at one time had obtained such glorious perfection in Hellenic hands. The plastic art in all materials had risen under their guidance to the highest excellence which the world has ever known, or probably will ever know again. Its progress had been gradual, its fall rapid; yet it is difficult to conceive, with monuments so superb still existing and around, that it could have been permitted to sink so far. In truth there was no healthy soil for the encouragement of art in her higher walks; merely a certain amount of technical ability was still maintained to administer to the pride of vanity and the lust of the eye, in fashioning innumerable iconic statues and busts, and in the fabrication of ornamental figures and vessels in rich or costly material. The downward tendency was however very swift, and the depth to which it fell in Italy was very low. The troubles and weakness of the Western Empire increased, while the wealth of Byzantium attracted the more competent artists, who there retained many of those processes which were gradually almost lost to Rome, until the returning tide, forced northward and westward by the storm of iconoclastic persecution raging during the eighth century at Constantinople, dispersed Byzantine artists and Byzantine forms of art throughout the greater part of Europe.

Early Christian art, doubtless of high interest because of its symbolical reference to biblical and apostolic history, and to the doctrines of our religion, was nevertheless for the most part extremely bad, nor did the steady increase and influence of the faith carry immediate improvement with it, but rather the reverse. From the fourth century until the tenth its manipulative faculty was continually on the wane, although we cannot but recognise an increasing effort to express a higher sentiment struggling with the incapacity to represent material form correctly.

Without any contemporary portrait from the life, unable, and perhaps from reverential motives at the first, unwilling to attempt a representation of the features and figure of the Saviour, a symbolism was adopted, which soon became an accepted method of representation, and the more so from its not being comprehended by those yet unconverted to the faith. It is recorded that Alexander Severus ordered a statue of Christ to be sculptured, but there was no earlier model as a guide, and had it been executed the work must have been purely imaginary. The Christian had therefore to be satisfied with a typical emblem or monogram, or at most with the representative figure of the Good Shepherd; a youthful form in rustic dress, bearing a young lamb upon his shoulders, and with a shepherd's staff in his hand.

(*To be continued.*)

JEWELLERY, SILVER AND ELECTRO-PLATE AT THE MELBOURNE INTERNATIONAL EXHIBITION.

THE special correspondent of the *British Trade Journal* at the Melbourne International Exhibition writes:—

"The exhibitors of electro-plate, silver goods, and jewellery are by no means numerous. Although it is pleasing to note that in one direction home makers have improved—there being seven exhibitors of electro-plate, as against two at Sydney last year—yet the display of jewellery is almost limited to German and Victorian houses; and although I have reason to believe that many specimens of the English jeweller's art are to be seen under other colours, still Great Britain proper contributes nothing valuable in this section. The whole display consists of two cases of brass jewellery, no doubt very good in its way, but scarcely the sort of goods one cares to see representing the Old Country in an important branch of trade. Germany has contrived to give special prominence to her jewellery exhibits, having grouped them under a reproduction of a most gorgeous imperial tent adjoining the picture galleries. Perhaps the most imposing exhibit of electro-plated goods is that of Christofle and Co., of Paris, which occupies a position immediately opposite those of Great Britain under the dome. This firm appears to make a speciality of dessert, fish, table, and tea sets, together with large candelabra and reproductions of ancient metal work. In the American court there seems a void in this class of goods, for the magnificent collections shown by Messrs. Reed and Barton, and the grand silver goods displayed by the Gorham Manufacturing Co., which attracted the lion's share of public patronage in Sydney, are unaccountably absent, and almost the sole representatives of the stars and stripes are Messrs. Simpson, Hall, Miller and Co.

"Some few very meritorious collections are shown by various colonial firms; but, with one exception, the cases are small, and are not representative. The one, however, which really deserves more than a passing notice is that of Mr. Steiner, of Adelaide, which serves as a very fine introduction to the South Australian division—perhaps the most attractive court in the building, although the race between that colony and Queensland on the one side and New Zealand on the other is pretty close. This meritorious Adelaide exhibit consists principally of silver ware and electro-plate, the latter comprising trophies of various athletic gatherings, whilst the silver serves as very artistic mounting for emu eggs. Indeed, these mounted eggs, contrasting their deep green with the bright silver, give to the case quite a distinctive appearance. The whole of the contents of the case are of colonial manufacture. Messrs. Kilpatrick and Co., of Melbourne, show some very chastely engraved mounted glass beakers, the mountings being silver gilt.

"Certainly the finest exhibit put forward by Great Britain in this class is that of Messrs. James Dixon and Sons, of Sheffield and London, most properly represented by a special agent from the works, Mr. Allan Hedderly, who has arranged the varied goods entrusted to him very satisfactorily. The firm, whose goods cover a wide range, show them in two cases, the smaller one being exclusively filled with electro Britannia metal, and Britannia metal goods, principally consisting of coffee and tea sets, all of modern design. This ware certainly is a credit to the firm, and from its utility should command a market among this somewhat prosiac people. The larger case, over which floats a handsome silken banner, 'Great Britain,' placed by the executive to denote the court, contains principally dish covers, coffee sets with kettles to match, prize cups, revolving tureens, and many other specimens of most elaborately finished electro work. A massive centre-piece of oxydised silver attracts much attention from its faithful reproduction of nature. It consists of an oak tree, beneath which are grouped several farm animals, such as the horse, sheep, etc., the models being very accurate. This really splendid agricultural trophy is supported on either side by massive silver challenge cups of 120 and 160 ounces respectively, and two magnificent gilt plateaux and stands. A massive gilt Corinthian candelabra stands at each end, and appropriately completes a set of goods which have no equal in the exhibition.

"Next to this exhibit Messrs. Briscoe and Co., of Wolverhampton and Melbourne, display in a joint stand the productions of Messrs. Horace Woodward, of Birmingham, and Messrs. Boardman and Glossop, of Sheffield. The names of the Melbourne agents at first covered the entire stand, and they appeared in the catalogue as the exhibitors of the articles, but the officials of the British Court interfered, and now the manufactures appear under their proper flag. It is very unpleasant to see English firms fostering this sort of thing. The goods displayed by Messrs. Horace Woodward and Co. have several important features, a very attractive piece being an ivory and polished gilt fruit-stand, with Corinthian caps, the blending of the rich cream and gold having a very charming effect. Some revived Worcester porcelain gilt mounted is very novel, though somewhat out place of in an electro-plate exhibit. Some handsome epergnes, dish covers, and smaller goods complete a very good collection. Very similar are the manufactures of Messrs. Boardman and Glossop, of Sheffield. A complete dinner and tea service, including a large urn with ancient chased figures on a frosted ground, are very conspicuous for their novelty and elegance.

"Messrs. W. W. Harrison and Co., of Sheffield, whose elegant little case has got somewhat crowded into a corner by its more imposing, but not more meritorious neighbours, have a very choice selection of fish and dessert sets, very elegantly engraved on silver and parcel-gilt groundwork. Five o'clock tea sets shown by them particularly attract the attention of the ladies, one set, especially, engraved to represent willow pattern plate, being very uncommon and tasteful. Special prominence is given to a facsimile of a sugar basket recently manufactured for our Queen, displaying perfect taste. The whole of these goods are plated on nickel silver, and are of various qualities. The firm is represented by Mr. J. Elkinton.

"A large and handsome Melbourne-made case contains the goods shown by Messrs. Walker and Hall, of Sheffield. The five elegant cases originally shipped were unfortunately greatly damaged by the accident to the 'Sorata,' otherwise Messrs. Walker and Hall had the largest exhibit of electro-plate and silver goods. Their present exhibit, which is in the hands of Messrs. J. McEwan and Co., brings to mind painful associations, for in our little circle of Englishmen, so far away from the mother country we feel deeply the loss of such a genial spirit as the deceased partner of this firm, Mr. Spencer Hall, recently so full of life among us at Sydney. The case shown by the firm contains many very fine specimens of the electro-plating art, which find a ready market in these colonies. Two particularly striking pieces are a large parcel-gilt tray, most handsomely engraved in Japanesque design, and a massive parcel-gilt Etruscan vase, surmounted by a capitally modelled figure of an ox. This latter will no doubt appear as a first prize at one of the many agricultural shows in the neighbourhood. Messrs. Walker and Hall's exhibit took the first prizes at the Sydney Exhibition for this class of goods, and it is to be regretted that their present opportunity is so much spoiled.

"The division in this class is completed by a joint exhibit of Messrs. Lee and Wigfull, and Messrs. Roberts and Belk, both of Sheffield, shown through Messrs. J. McEwan and Co. The case appears of colonial manufacture, and its contents are so mixed that in referring to them the respective exhibitors must recognise their own productions. The goods are in great variety, principally of smaller articles, such as cruets, jugs, cups, and some very pretty little sets suitable for the dressing table. Some inkstands with figures, too, are shown, but I do not think that, for the price at least, Sheffield can compete with Vienna in this class of goods. A very handsome piece that attracted attention was a jug and salver in bright gilt and old silver, the two colours blending most harmoniously."

EXHIBITION AT LA CHAUX-DE-FONDS (SWITZERLAND).

An exhibition of watches, clocks, movements, etc., and of tools and machinery employed in their manufacture, will be held from the 1st to the 31st of July next, at La Chaux-de-Fonds. The prospectus before us divides the exhibition in two sections, the competition of the first being *National only*, while the second is *International*. Each section is subdivided into five groups, as follows:—

Section I. (*National.*)

1. Complicated watches and watches of precision, ordinary timekeepers.
2. Electric and pneumatic clocks, pendules, regulators, alarums, etc.
3. Watch movements, remontoir and other mechanisms, escapements, etc.
4. Detached pieces of every description.
5. Cases of every description.

Section II. (*International.*)

1. Measuring instruments.
2. Motors and transmitters.
3. Machines and tools.
4. Metals, chemical products, furniture, etc.
5. Models, designs, special treatises, and publications.

The spaces are provided free of charge, and exhibitors have only to pay a small fee, according to importance of exhibit, towards defraying the expenses of administration.

The committee will take the necessary steps to secure for exhibits a reduction in the railway charges, free entry from foreign countries, and the best terms for insurance against fire. Applications for space must be addressed before the 15th of April to the *Commissaire Général de l'Exposition*, Chaux-de-Fonds (Switzerland), who will supply the required forms. Exhibits for the 1st section must be sent in before the end of May, those for the second before the 15th of June. Diplomas and medals will be awarded to successful exhibitors. We may add that the committee list is a very influential one. We shall be glad to give intending exhibitors any further particulars they may desire on application to the office of this Journal.

THE ART OF THE SILVERSMITH.

By W. Herbert Singer.

(*Concluded from page 93.*)

In France, or Germany, the master is often artist, workman, manufacturer, and merchant combined; technical education being more common in those countries than with us. But in England the master is generally a man who does nothing himself but receive the orders given to him; he hands these on to his foreman, who distributes the work amongst the workmen. Naturally, individual skill and merit occasionally come to the front, and from our division of labour great success has been obtained in various processes; but as to the certainty of a good result, who would think of apprenticing his son to a silversmith, if he had any other branch in life open to him? And thus the result of our doings in modern times has been that during the reign of George IV. we had the "king's pattern" epoch, and that now we have come to the "fiddle pattern" era, and this we can only manufacture in three or four places in England, whereas a steam-engine can be made in hundreds of towns and villages of this kingdom.

Now, this state of things can, as far as I am able to see, be only obviated by, firstly, the repeal of the duty, and this is irrespective of the question of hall-marking. Hall-marking existed long before the duty, and there is no reason why it should not continue long after the tax has been removed, if it should be thought advisable. My hope is that, at no very distant time, a thorough reform may be effected. I ask for nothing less than perfect freedom. I would then suggest that a great change should be attempted in the teaching of apprentices to this art, it being now too often learnt by the rule of thumb.

We have, as I pointed out, schools for instruction in the liberal professions, and if this art is to be great in England we must have a grand central school, in which a thorough education can be given to the silversmith—a veritable college for metallic art. *The question naturally arises, Who will, or who can, found such an institution?*

I am aware that a number of the City Companies have subscribed, and propose to found, a university for the promotion of technical education. I do not know if in any department of this college an atelier will be formed in which the art of the silversmith will receive especial attention. In my opinion, a practical school is required, where on one day there would be a class for engraving and chasing, on another for *repoussé* work, on a third day enamelling, the fourth day soldering and hammering in all its variety, then the setting of precious stones, with the essay of metals, also instruction in drawing and modelling. There the pupil should also learn damascening, niello, and incrustation. If such an article is not included in the scheme of this institute, I beg to be allowed to state that every endeavour should be made by those interested in this art that a portion of the college should be devoted to this purpose, for I believe it to be the only means by which the silversmith's art in England can be raised to the level it has reached on the continent and in America.

The means for accomplishing this noble purpose may, perhaps, be obtained by all the wholesale and retail silversmiths in Great Britain annually subscribing a sufficient sum to maintain this school for art workmen. But there is another source from which I think we are entitled to look for help.

In this City there is a great and rich Company, ostensibly the patron of silversmiths, and the protector of all working in the precious metals, that derives its existence, authority, and wealth from this industry. I refer to the Goldsmiths' Company. They have certainly done something to encourage the silversmith's art by offering prizes and scholarships, but there is a far wider scope for their influence if they would carry out the rôle belonging to them. What a small sum out of its vast revenues would it take to form a few classes to teach the subjects enumerated, having three or four skilled workmen to practically illustrate the various processes.

With such a college in which to train those who wish to follow this beautiful art, and under conditions of that perfect freedom which I hold to be essential to its development, we may reasonably hope that the silversmith's work of the Victorian age would soon be found worthy to rank with the noblest works of ancient Greece and Italy.

THE WATCHMAKER JEWELLER AND SILVERSMITH'S TRADE JOURNAL.

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

Entered at Stationers' Hall.—Registered for Transmission Abroad.

CONTENTS.

	PAGE
The Application of Hand Work	123
Flexible Shafting for Tower Clocks	124
Repairing Swiss Watches	124
Exports of Watches and Musical Boxes to the United States of America	124
Machine Work *versus* Hand Work (A Reply to James U. Poole)	125
The Construction of a Simple but Mechanically Perfect Watch	126
Book Notices	127
Hints to Repairers	127
Practical Instructions to Jewellers, Silversmiths and Electro-platers	128
Reform of the Patent Laws	129
Lectures on Watch and Clock Making	130
Trade Notes	132
Construction of Timekeepers Delivered to the Board of Longitude, March 7, 1805	133
On the Fluctuations in the Relative Values of Silver and Gold, with Special Regard to the Present Depreciation of Silver in India	134
Bronzes	135
The Diamond Fields of Griqualand West	136
Industrial Training	137
Duty on Silver Plate	138
Bills of Sale	ii
Patents	iii
Monthly Record of Bankruptcies	iv
Directory	vi
Advertisements	i—xvi

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THE APPLICATION OF HAND WORK.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—In my previous letters I dealt with the mode by which apprentices were taught to handle their tools, taking the lever escapement as an illustration, which was the special branch I learnt myself, and the knowledge of which I believe to be of the utmost importance to a practical manufacturer. With your permission I will now continue in very much the same strain, showing how the skill acquired in the manipulation of the escapement may be applied to every other part of the watch, including springing and timing.

The construction of many parts of a watch by machinery is an accomplished fact, but it is certain that skilled hand work will be called into requisition as long as time, and time measurers, shall continue.

I have read the reply of Mr. Whittaker up to this point with interest, and only desire to refer to the paragraph in which he combats my assertion that a chronometer escapement cannot be constructed by machinery. Singular to say, at the second lecture given by Mr. Rigg at the Society of Arts he gave two illustrations of the capabilities of machine tools, and the materials were supplied by the very gentleman whose enquiry about a balance staff was quoted by Mr. Whittaker. Mr. Rigg first showed on the disc a train of wheels to a two-day chronometer, which he said came fairly within the scope of machinery. A detent was then shown as being impossible to be made otherwise than by hand. Considerable interest was manifested by the audience by the exhibition of the elastic properties of the weak part, which was bent by Mr. Rigg nearly at right angles to the foot, and instantaneously recovered its proper position. It is sad to think that the manufacture of pocket chronometer escapements is rapidly becoming a lost art. Owing to the skill required in cleaning chronometer watches, the sale of them has been systematically discouraged by the majority of shopkeepers, and at the present time I do not know of one chronometer escapement maker who is entirely at the service of the trade. Some of the more experienced workmen have been driven out of the market in consequence of the superior embellishments which have come in of late years, and which were considered of minor importance thirty or forty years ago. Many ingeniously constructed small tools, mostly original, came into requisition for the purpose of producing beauty of finish, although not assisting in rapidity of production, and without doubt the making of these tools developed the latent powers of learners quite as much as the actual work itself; but I maintain that the comparatively plain work of our grandfathers has not been surpassed for correctness of principle and action, and that we require the skill inherited from them to set off to the best advantage many of the more showy productions of the present day. A chronometer escapement, like a repeating movement, is not supposed to be in perfect condition when delivered up by the actual maker; but the supplementary skill of the springer and timer has still to be called into requisition, who frequently has to make delicate corrections to every part of it; and seeing that the chronometer is an essentially English instrument, it is only reasonable to suppose that the skill which is required to superintend its manufacture may be applied to advantage to every other description of watch.

To my own knowledge many expensive complicated watches of Swiss manufacture have been entirely useless until re-examined here, so that in one sense our inherited skill has been applied to our own disadvantage, as we assist in giving a good name to the productions of rivals.

It is impossible to impart this description of skill to learners by any definite process of instruction, and as a matter of fact only a very small percentage rise above the condition of ordinary workmen. Many of our leading horologists have learnt their business almost in spite of their employers, but in face of the flood of light now thrown upon every department by our horological literature it is reasonable to expect that all desirous of making progress will have the opportunity of doing so. In my next paper I propose to deal in an elementary manner with the process of springing and timing an ordinary ¾-plate lever watch.

I am, &c.,

James U. Poole.

33, Spencer Street, Clerkenwell.

FLEXIBLE SHAFTING FOR TOWER CLOCKS.

PHILADELPHIA has recently adopted a time-ball similar to that used in New York. The automatic apparatus for dropping the ball at noon was devised by the builder of the clock, Mr. G. W. Russell, the city timekeeper. To a delicate hair trigger the armature of a magnet is attached, so that when the electric current is passed through the magnet the movement of the armature sets off the trigger and lets the ball drop.

The current is sent to the magnet in a very simple manner. In the clock are three wheels, one of which revolves but once in twenty-four hours, the other once in one hour, and the other once in a minute. In each of the three wheels is a notch, and, of course, these three notches can be in the same straight line but once in twenty-four hours. This occurs on the completion of the last second before noon, and then a lever attached to the escapement drops into the notches, completes the electric current, and sets off the hair trigger.

The time-ball is placed above the clock tower of the Union Insurance Company's new building at Third and Walnut-streets, and is visible from a long distance.

Owing to lack of space it was found inexpedient to put the machinery of the clock in the tower, so it was placed in a separate loft and connected with the dial by flexible shafting This avoids obscuring the skeleton dial by the boxing that would have been necessary with the usual right angle connection. Mr. Russell claims that this is the first application of flexible shafting to tower clocks, and that the result has been satisfactory. The time is taken daily from Washington.—*Scientific American.*

REPAIRING SWISS WATCHES.

By H. Ganney.

NO. 7 of these articles will appear in our next, as the manuscript came to hand too late for present issue.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—We regret Mr. Poole should evade the direct and pointed challenge to produce the proofs we called for, and take refuge behind vague statements made by other people.

The interpretation he puts upon our advice to Mr. Glasgow is not sustained by anything we said in our letter to a contemporary; and the reference to a large American order for dials given to a Clerkenwell maker is valueless, by reason of facts connected with that order which Mr. Poole can learn about on enquiry.

The amendment of his "somewhat obscure sentence" is not improved by these references, and as amended we dispute its correctness: "similar work" is *not* executed here. We should agree if he had stated, similar work is executed in France and Switzerland, sent *here*, and *sold as English.*

It is surprising to us that a recognised leader of the trade like Mr. Poole should cling to the bygone good times of Clerkenwell, and believe its departed supremacy must still prevail—its styles and methods of manufacture, the outcome of a past generation, equal and prove superior to the growth and improvements of the present. Why not, Mr. Poole—having at heart the re-establishment of the waning watch industry of your neighbourhood—go to America, and learn by experience the system of watch manufacture? See and learn that which aroused Favre-Perret, who hastened home to declare to the great watchmaking centres of Switzerland they were blind to the vast improvements and perfection to which the art of watchmaking had arrived, and that something must be done or their greatest industry would be destroyed.

We have no doubt Mr. Poole would meet with a courteous reception; as for ourselves and the American Watch Company, we guarantee it. A visit to our factory would convince him he is all wrong; and the only manner in which Clerkenwell can produce "similar work" to that produced by the American Watch Company, is to pull down and rebuild, wake up from the Rip Van Winkle sleep, and understand this is an age of steam and electricity, *not* the days of slow coaches and postboys.

Yours, &c.,

Robbins & Appleton.

March 9th, 1881.

EXPORTS OF WATCHES AND MUSICAL BOXES TO THE UNITED STATES OF AMERICA.

	Watches.	Musical Boxes.
1864	8,477,192 francs.	72,482 francs.
1865	11,301,954 „	108,399 „
1866	13,093,408 „	300,108 „
1867	10,362,418 „	265,196 „
1868	10,469,728 „	344,448 „
1869	13,322,578 „	258,738 „
1870	16,512,162 „	341,148 „
1871	17,105,752 „	350,637 „
1872	18,312,511 „	441,852 „
1873	13,054,147 „	433,573 „
1874	12,119,941 „	252,817 „
1875	8,499,501 „	186,523 „
1876	4,809,822 „	141,357 „
1877	3,569,048 „	102,105 „
1878	3,995,716 „	95,679 „
1879	5,292,098 „	187,759 „
1880	10,143,812 „	261,833 „

MACHINE WORK *versus* HAND WORK.

A Reply to Mr. James U. Poole.

No. IV.

(*Continued from page* 108.)

MR. POOLE is quite correct in stating that machine work will always have to be supplemented by hand work; and in my article in the February issue of this JOURNAL, I promised some remarks on this subject. I regret having made the promise, because it is premature to speak of supplementing before you know what you are going to supplement, and no definite statements can be made on this subject until the extent of machine work is clearly defined. Suppose we transfer ourselves back to the times when wheels were divided and cut by hand, and that we have to make a 4th wheel with 63 teeth: We will first make a brass blank with five arms in the manner referred to at page 73; then with a pair of compasses divide the wheel into 126 equal spaces; with an equalling file cut out 63 spaces, leaving 63 teeth; with a barret file, sometimes called a bevil-edge file, carefully clean out the bottoms of the teeth, leaving them as square as possible; and then take a rounding-up file to round up the teeth. The patience and skill required for these operations can better be imagined than described; but I estimate that it will occupy a week to make a wheel by hand. Having got such a piece of hand work let us come back to our own times, and take twenty machine-made blanks, put them into the cutting engine, and with suitable cutters driven by steam power and a self-acting dividing-plate, proceed to cut the twenty wheels, which will occupy a girl about three minutes. By the side of the hand-made wheel lay one of the machine-made wheels, and ask yourself this question: What is the use of the compasses, the files, and the skilled hand work that applied them in operating machine tools in the manufacture of wheels? The answer will be, Of no use whatever. Further assume that every part of the watch is made by machinery—and as I proceed to examine Mr. Poole's letters, I will place this beyond doubt—then we come to the momentous question: Is skilled hand labour really necessary? Yes, chiefly because the work of the machine is not always alike—the wear of the cutters and other parts of the tool will cause a difference in the work; a variation in temperature will affect both the tools and the work; an inequality of speed at which the tool is worked will produce bad results; carelessness on the part of the operator is a fruitful source of error; a want of homogeneity in the metal will sometimes defeat our best efforts.

The machine reduces the hand work to a minimum. It is the business of skilled hand labour to remove the slight and yet variable defects left by machine-tools; it is required to impart the life-giving touch of the sculptor and not to hew the stone out of the quarry. Not so much the hand as the eye comes into play, guided by the judgment and intelligence of the operator; the artisan becomes an artist. Much hand work after the machine implies that the latter has done its share badly.

Assuming the work has been made as far as possible by machinery, final adjustment does not represent 10 per cent. of the present labour-cost of production, and while I admit the necessity of skilled hand labour, I assert at the same time also the necessity of machine-tools.

In Clerkenwell and all the manufacturing centres in the country, we have for more than twenty years had a superabundance of this skilled hand labour, while the machine system has been conspicuous only by its absence. In all directions we are deluged with men that possess marvellous cunning in their right hands, and yet they can scarcely find a days' work to do, even in this great city of London; and under such circumstances is it not absurd to be constantly insisting upon that which all admit, to the neglect of equally important matters?

Let me lay the case before you in another form. Suppose I say a litle *water* is necessary to supplement the work of the machine—and this is quite true, a watch cannot be gilt without water—that the New River has overflowed its banks and deluged Clerkenwell; that under the damp and depressing influences of superfluous water I was to write to the editor of a local paper: "In order to keep up this supply of water a special river is required, and I propose to go back some 250 years and detail some of the methods by which Sir Hugh Mydleton inducted the New River into Clerkenwell," and continue writing in this strain for the space of four months, would it not be a wiser plan to open some of the channels by which the redundant element could escape into fair and fertile fields, and by its presence make them very fruitful?

Again suppose you knew a manufacturer who was over careful to preserve intact one-tenth of the producing power in his factory to the neglect of nine-tenths, would you purchase his goods or recommend them to your clients.

I have frequently seen Mr. David Glasgow take *a piece of American machine-made watchwork*, and holding it up ask, "Where is your English workman that can do anything to equal this at the price." If Mr. Glasgow was a little better informed in these matters he would not vent his virulence on English workmen, but would encourage labour-saving machinery, so that we could enjoy the same advantages of applied science that other countries possess; then our workmen would be a match against the world.

As a fair specimen of our indifference to the advantages referred to—our innate love of taxation, our determination to handicap our workmen—I may mention that during the past month I have examined a new wheel-cutting engine that has been made expressly for the use of the pupils at the School of Horology at the Horological Institute, and find it void of every modern improvement, *e.g.*, the cutter works in a rocking frame instead of a slide, so that a segment is left at the top and bottom of the teeth. The dividing plate is not self-acting, which causes a loss of time at the cutting of each tooth, and considering that there are over 500 such operations in a high-train watch, the loss is considerable. It has a gallows for holding the work, which is a very slow process compared with a sleve arrangement that will take twenty wheels at a time. It has not got even a pump cylinder, and though that does not insure perfect truth, it greatly facilitates the work. The dividing-plate is 14 inches in diameter, which does not allow the operator, especially if he is small in stature, to get sufficiently near the centre to examine the truth and cutting of the work when it is small, say a six-size scape wheel. The dividing-plate should be drum-shape, with the divisions in the periphery, and should not exceed eight inches in diameter. This defect in a wheel-cutting engine has been pointed out and remedied as far back as the year 1793.* Strange to say in this iron age it is mounted on a wooden frame, and can scarcely be said to have an over-head motion. The engine seems as if it were specially designed to produce the smallest amount of the worst work in the longest time, so that any workman or manufacturer using such an engine goes into the market with an unnecessary cost on his work, and is unable to compete with those who use superior tools. Instances of this kind I can indefinitely multiply.

The difficulty that lies before an English watch manufacturer is this,—he must first reduce the price of his work 25 per cent., and increase the earnings of his workmen 25 per cent., and to accomplish this he must avail himself of the advantage offered by machine-tools. The present method of a manufacturer in reducing the cost of his work is to lower the wages paid to his workmen, who in turn reduce the quality; hence loss of reputation, and bad trade.

RICHARD WHITTAKER.

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* See Mr. E. Troughton's letter to Sir David Brewster, *Edinburgh Encyclopædia*, Vol. 10, Article Graduation.

THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.*

By M. Grossmann, Watch Manufacturer,
Glashuette (Saxony).

(*Continued from page* 111.)

77. The disposition of the cylinder escapement being not so extended as that of the lever escapement, the space in the movement is not so much occupied, therefore the train, to begin with the centre wheel, can be made one size larger than in a lever movement of the same diameter, in order to secure the advantages to be obtained thereby (53).

78. The cylinder escapement is at this period nearly superseded in almost all countries except France, by the lever escapement, and with respect to this latter, there are a few more observations to make.

The arrangement of this escapement admits of a great variety, and in the first place the question must be settled, whether it is to be set in a straight line or at right angles. This latter system recommends itself by an economy of space, or, what is the same, by a more convenient placement of the parts. Thus it would allow the wheels, lever, and pallets, to be made larger for the same size movement. For the reasons alleged for the sizes of wheels and pinions (53), this might appear advantageous, but in the case of the escapement we have to consider it from another point of view. We must consider in the first place, that in the intermittent action of a dead beat, or detached escapement, the inertia of the moving parts must be overcome at each vibration, and that this impediment must be reduced as much as possible. Besides the sliding friction of the wheel on the pallet planes is of a very different nature from the rolling friction of the wheel teeth, and this former kind of friction increases considerably with the extension of the planes to be traversed. For these reasons the wheel, pallet, and fork, ought not to exceed certain limits in size, and they ought to be worked out as light as their necessary strength will allow. The length of the fork, too, must be restricted. I will not repeat here what I have treated in full detail in my "Treatise on the Lever Escapement," chap. ix., p. 62. The action of the fork and roller is also not of such a very delicate nature as to make us wish to execute it on a large scale in order to verify easier its performance.

For the same reasons it is not advisable to make the wheel or other parts of the escapement of gold, the specific gravity of which is here an objection.

79. The arrangement of the escapement in right angles offers thus, as we have seen, no advantage by its economy of space, except in complicated constructions, where the space is restricted by other parts of the mechanism. It may be considered but little more than a matter of taste to employ the one or the other arrangement, still there is a slight difference in favour of the escapement in right angles with respect to the friction.

The pressure which is acting on the pallet pivots may be considered a threefold one. 1st. The pressure of the wheel on the locking faces. This is exerted with the full power of the escape wheel, and acts on both arms in the direction of a line drawn through the locking edge of the entrance-arm to that of the other arm, and will tend to wear the pivot holes in the direction of the second arm. 2nd. The pressure resulting from the decomposition of the force of the wheel when acting on the inclined planes of the pallet. It is, of course, much weaker, but it acts during a more extended angle of movement. It increases with the lifting-angle, and has a tendency to widen the holes in the direction of a straight line from the centre of the wheel towards the centre of the pallet. 3rd. The reaction of the resistance in unlocking. It acts alternately to both sides of a line at right angles with the line joining the centres of balance and pallet. Both the effects under 1 and 2 take place equally and in the same direction for any lever escapement, but the third one coincides in direction with that under 1, if the escapement is in straight line, while with the escapement in angle it falls into the direction of the one under 2, which is essentially weaker. This difference, which has also been explained in the above quoted treatise, is of subordinate importance.

In all cases of this latter construction, the pallet holes, as a rule, ought to jewelled, because the bushing of a worn pallet hole in a straight line escapement is more troublesome than in another one, as any deviation of the exact pitch must necessarily here produce a defect in both the actions of wheel and pallet, and of fork and roller.

80. According to the foregoing demonstrations, the diameter of the escape wheel in a lever watch ought not to exceed one-fifth of the diameter of the pillar plate, and then it will be a good proportion to have the acting length of the lever—that is, the distance from the pallet centre to the acting edges of the fork—equal to the wheel's radius, or one-tenth of the diameter of the pillar plate.

With these proportions the pallet centre will be within the circle of balance, if this latter is not disproportionately small.

81. There might be found a trifling economy in having wheel and pallet under one and the same cock, but then we would have either to renounce the advantages of a short lever, or to make the escape pinion as short as the pallet staff which is to lie under the balance. This ought to be avoided, because the stability of the axis is greater when the pivots are far apart (60). Therefore the little additional trouble or cost of making a separate cock for the wheel ought not to be an objection.

82. The action of the fourth wheel into the escape-pinion ought not to be placed too high, for, if otherwise, the good service of this depth, by its nature the most imperfect and most delicate of the train, might be endangered by the slightest alteration in the steady pins of the escape wheel cock. For the same reason, this cock ought to be placed so that a straight line through the pivot hole and the screw hole points towards the centre of the fourth wheel, or nearly so, because then any bending of a steady pin will influence the depth in a less degree.

83. The balance cock, in the course of making or repairing a watch, must be very often removed and put on again, therefore it is of great importance to pay much attention to its steady pins, for if badly made they give much trouble. A well-adjusted cock, especially that of the balance, ought to be firm in its place; it ought to go easy into the steady pin holes till at a distance of some tenths of a millimetre, and then be so firm that the escapement may be safely tried without using the screw. This result can only be attained by steady pins of a conical form. I would not recommend the English way of screwing the steady pins in, because it is not easy, and does not offer the same surety of exact fitting as a pin driven into a round hole. The following is a way to do it, which I always found to answer perfectly well. I take a piece of wire, a little thicker than the hole, and file it to the ordinary taper of a broach, till it will enter about half-way into the steady pin hole in the pillar-plate. Then I take a burnishing file, and holding the pin with the pin vice in a suitable groove of the wood in the bench-vice, I apply the burnisher to its end, so as to burnish a length a little more than the thickness of the plate into a more conical shape than that of a broach. After this, if properly done, the conical part of the pin will enter fully into the hole in the pillar plate. Then I take a good broach, and make the correspond-

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ing hole in the cock wider, till the pin, thus prepared, goes in far enough to have its extremity level with the lower surface of the cock. This, however, is a matter of experience, because it depends on the relative hardness of the cock and of the pin wire, and on the respective taper of this latter and the hole. Then I cut the wire off, leaving a sufficient length projecting at the upper surface of the cock, and then, after putting the lower side on a piece of flat steel, with a hole in it only a trifle larger than the pin, I drive the pin tightly in, trying it from time to time into the hole in the pillar plate, till it holds the cock fast. The other pin is made in the same way, and a cock well fitted according to this principle goes on quite easy till the pivot is in the hole, and then it gets more than sufficient hold by the last pressure, which may be exerted safely and without injuring the jewel hole. These conical steady pins offer the additional advantage that a small bending of them will not effect the position of the cock, because, in consequence of their taper form, they catch their hold in the plate merely by the part next to the cock, while the parts of the pin exposed to bending are free in the hole.

(*To be continued.*)

BOOK NOTICES.

A New Artistic Alphabet. Designed by Theodore de Bry. George Waterston and Sons, London and Edinburgh.

This is a reproduction, without the text, of an alphabet originally published in Frankfort-on-the-Maine in 1595, and now extremely rare. The fine copy in the Print Room in the British Museum, bound in red morocco, cost its late possessor, Mr. Felix Slade, £31 10s. at the sale of Mr. Charles Price in 1867. Theodore de Bry was born at Liege in 1528, settled at Frankfort in 1570, and died there in 1598. He was a goldsmith and designer, as well as an engraver and etcher on copper, and one of the most industrious artists of his day.

Goldsmith's Handbook. By G. E. Gee. London: Crosby, Lockwood & Co. A new edition of the excellent work entitled the "Practical Goldworker."

The title has been altered so as to bring it in harmony with that other valuable work by the same author, the "Silversmith's Handbook."

This second edition under notice has been brought out as an addition to the most useful and well-known series of handbooks called "Weale's Series," at a reduced price.

Allgemeines Lehrbuch der Uhrmacherkunst. By Albert Johann, Watch Manufacturer, Aarau, Switzerland.

This is an excellent, clearly-written and well-illustrated treatise on watchmaking, and the only fault we can find with it is that it is written in German, and therefore only accessible to those conversant with that language. Many high authorities on horology have spoken of this treatise in eulogistic terms. Our article on "Depthing," in the January Number, was drawn from this source. Mr. H. Bush, of Hull, supplies the work.

Modern Alphabets. By Martin Gerlach. London: A. Fischer, 28, Finsbury Pavement, E.C.

A series of entirely new and original designs of ornamental initials, etc. "Industrial Monograms" and "The Pearl," now so well known to the trade and published by the same firm, are sufficient guarantee that "Modern Alphabets" are worth buying.

HINTS TO REPAIRERS.

(*Continued from page* 45.)

One frequent cause of a watch performing badly can readily be traced to its imperfect jewels. A watchmaker should always carefully examine every jewel in a watch that he has down for repairs, and if he finds one the hole of which is too large, or very much "out of round,"—that is, much wider in one direction than another—it should be replaced by a good one, as follows:—If the depth is correct, notice whether the jewel is above or below the surface of the plate; if it is either, then knock it out, and cement the plate or bridge on a chuck in the lathe, being careful to get it on true by the hole lately occupied by the jewel; by means of a burnisher, raise the burr that holds the other jewel in, and if a jewel can be found of the proper size and thickness, and the hole not too large, it can readily be "rubbed in" with the burnisher; if the hole is too small it can be opened. The chuck on which the article is cemented should have a hole from a quarter to half an inch deep in its centre. If no jewel can be found of the right size and thickness, select one a little too large, enlarge the whole sufficiently to fit the jewel, then proceed to fasten it in. If the jewel is broken, of course the same remarks apply to replacing it with a good one as to an imperfect one.

One difficulty that the watchmaker has to contend with in selecting a jewel from the indifferent ones supplied by some dealers, is to find one the *hole* of which is in the centre of the jewel. If a jewel is not true, or rather if the hole in it is not in the centre, it must be cemented into a chuck in the lathe, trued up by the hole, then turned off with a diamond cutter, and the chamfer carefully trued up and polished again; while in the lathe it can be turned down to fit the hole in the setting or plate; the shellac is to be removed from the plate with alcohol. In many instances a chuck will have to be turned up to suit the particular job to be done. Care must be taken in opening, or the jewel will break or chip around the hole. The corners must be carefully rounded by a piece of wire larger than the hole, the end of which is conical. It will take but a moment to do this, but if care is not taken too much will be taken off.

Imitation Waltham Watches.—No sooner has an article secured a valuable reputation, than inferior counterfeits appear in the market, the latest production of this nefarious traffic being "imitation Waltham watches." That these watches have been spotted out as profitable for imitation, and that the name "Waltham" should be found useful in effecting sales, are certainly proofs that the manufactures of the American Watch Company, Waltham, are looked upon with favour—a distinction which could only have been earned by a combination of quality and cheapness, because these watches had to battle with any amount of opposition and depreciation when first introduced. It appears that the name and trade marks of the company have been handled rather freely of late, and from an announcement in our advertising columns we judge that effective steps will be taken for stopping the practice. Up to the present the company have not succeeded in obtaining sufficient information to warrant a prosecution in this country, but they have recently instituted proceedings against two jewellers and an engraver of Philadelphia. From a report of the case in the *Philadelphia Press*, we gather that the engraver forged "P. S. Bartlett, Waltham, Mass., Patent Pinion," one of the well-known trade marks of the American Watch Company, on quantities of movements of but little value, and the other two defendants then disposed of the goods at their store as of genuine Waltham manufacture.

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. XXIV.

FOR imparting the whitish tint of articles gilt by stirring and of the gold alloy for jewellery, the red gilding is passed through a boiling and nearly exhausted bath of pyrophosphate, to which add one-tenth, or a twentieth, or a thirtieth of its volume of a silver bath, or simply a few drops of a concentrated solution of nitrate of silver. In either case a blush of silver is deposited upon the red gilding. This gilding should be scratch-brushed or burnished, and may be chased, but the lustre soon disappears on account of the proportion of copper. To obtain the proper pink gilding, if the first deposit is unsatisfactory, plunge the articles for a few seconds into a mixture of five parts of sulphuric acid to one of nitric acid. The copper and silver are dissolved, and the yellow gilding reappears, upon which the operation may be begun anew. Besides the variations of colour in gilding, due to the dipping of the anodes more or less into the bath and to the strength of the electric current, moving the articles about in the bath will at all times enable the operator to vary the colour or the deposit from pale straw yellow to a very dark red. The temperature of the solution likewise influences the colour of the deposit, the colour being lightest when the solution is cold, and gradually becoming darker as the temperature increases.

Gilding Watch Parts.—For gilding small articles for watchmakers gold is seldom directly applied upon the copper; there is generally a preliminary operation called *graining*, by which a grained and slightly dead appearance is given to the articles. Graining is done by different methods, and with gold, platinum and silver, but preference is generally given to the latter metal, so that we shall confine ourselves to graining with silver.

Preparation of the Parts.—Marks of the file are obliterated by a rubbing upon a wet stone, and lastly upon an oilstone. Any oil or grease is removed by boiling the parts for a few minutes in a solution made of 100 parts of water and 10 of caustic soda or potash. Rinse in clean water, which should wet them entirely if all the oil has been removed. Some gilders then pass the work rapidly through the compound acids for a bright lustre, while others only carefully dry it in white wood sawdust.

The pieces thus prepared are fastened upon the even side of a block of cork by flat-headed brass pins. The parts are then thoroughly rubbed with a brush entirely free from grease, and charged with a paste of water and very fine pumice-stone powder. Move the brush in circles, in order not to rub one side more than the other; thoroughly rinse in clean water, as no particle of pumice-dust should remain upon the pieces or the cork. Next place the cork and the pieces into a weak mercurial solution, which very slightly whitens the copper.

This solution is composed of—

Water, 2⅕ gallons;
Nitrate or binoxide of mercury, 1/14 of an ounce;
Sulphuric acid, 1/7 of an ounce.

The pieces are passed quickly through the solution, and then rinsed in plenty of water. This operation gives solidity to the graining. The work is then ready for the graining process.

Nothing varies more than the composition of graining powders; in fact, almost every gilder has his own formulæ, according to the fineness of the grain desired. The following are excellent recipes—

Graining Powders.—

1. Silver in impalpable powder, 1 ounce;
   Common salt, finely pulverised, and passed through a silk sieve, 2 pounds;
   Cream of tartar, also pulverised and sifted, 10 ounces.
2. Silver powder, 1 ounce;
   Common salt, white and clean, 13 ounces;
   Cream of tartar, 4 to 5 ounces.
3. Silver powder, 1 ounce;
   Common salt, white and clean, 2 pounds;
   Cream of tartar, 3 ounces.

All these substances should be as pure as possible, and perfectly dry. Cream of tartar is generally dry; but common salt often needs, before or after it has been pulverised, a thorough drying in a porcelain or silver dish, while it is kept stirred with a glass rod or silver spoon. The mixture of the three substances must be thorough, and effected at a moderate and protracted heat. The graining is the coarser the more common salt there is in the mixture, and it is the finer and more condensed as the proportion of cream of tartar is greater, but it is then more difficult to scratch-brush.

The silver powder is obtained by immersing cleansed copper plates in a very diluted solution of nitrate of silver made with distilled water. The more diluted the solution is, the finer is the precipitate of silver upon the copper, and the more easily it is removed. Into a glass or porcelain vessel, pour 2⅕ gallons of distilled water, in which dissolve ⅔ of an ounce of crystallised nitrate of silver; stir the solution well, and plunge into it 5 or 6 bands of cleansed copper, about ¾ of an inch wide. These bands should be long enough to allow of a portion being above the liquid. The whole is kept in a dark place for 24 hours, and now and then stirred with the copper bands. This motion is sufficient to loosen the deposited silver, and present fresh copper surfaces to the action of the liquor. When no more silver deposits on the copper, the operation is completed, and there remains a blue solution of nitrate of copper. The silver powder is washed by decantation, or upon a filter, until there remains nothing of the copper solution. It is then carefully dried, avoiding contact with hard bodies. Many operators prefer, however, to buy the ready-made Nuremberg powder, which is produced by grinding a mixture of white honey and silver foil upon a ground glass plate with a muller until the proper fineness is obtained. The silver is separated by dissolving the honey in boiling water, and washing the deposited metal in a filter until there is no remaining trace of honey. The silver is then carefully dried at a gentle heat.

Graining.—A thin paste made of one of the above powders and water is spread by means of a spatula upon the watch parts held upon the cork. The cork itself is placed upon an earthenware dish, to which a rotating movement is imparted with the left hand. An oval brush with close bristles held in the right hand rubs the watch parts in every direction, but always with a rotary motion. A new quantity of the paste is added two or three times, and rubbed in the manner indicated. The more the brush and the cork are turned, the rounder becomes the grain, which is a good quality, and the more paste added the larger the grain. When the desired grain is obtained, the pieces are washed and then scratch-brushed. The wire brushes employed, which usually come from Nuremberg, are made of brass wires as fine as hair, very stiff and springy. It is necessary to anneal them upon an even fire to different degrees, one soft or half annealed, for the first operation of uncovering the grain; one harder for bringing up the lustre; and one very soft, or fully annealed, used before gilding for removing any marks which may have been made by the preceding tool, and for scratch-brushing after the gilding, which, like the graining, must be done by giving a rotary motion to the tool. Decoctions of liquorice or saponaire are employed with the scratch-brush.

(*To be continued.*)

REFORM OF THE PATENT LAWS.

It is but little known that our patent law handicaps the British inventor 25 to 1 in favour of his most enterprising competitor, the American inventor. This painful fact is very clear on comparing the patent stamp duties of Great Britain with those of the United States. They are as follows:—

Great Britain.—Duration of Patent, 14 Years.

	Stamp Duty.
On petition of grant for letters patent	£5
On certificate of notice to proceed..	5
On warrant of law officer for patent	5
On sealing letters patent	5
On filing final specification	5
On letters patent before end of third year	50
do. do. seventh year	100
Total stamp duties on one patent	£175

The United States.—Duration of Patent, 17 Years.

On application for letters patent	£3
On issue of letters patent	4
Total stamp duties on one patent	£7

We thus see that the stamp duties in this country are twenty-five times as great as those of the United States, although an American patent lasts three years longer than a British patent. What is the effect of such a vast difference in the treatment of inventors in the two countries? We find that for every one patent granted here there are three granted in the United States, after making due allowance for the greater population of the United States. This means that the industries of that country have three chances of improvement to every one that ours have. Our prosperity as the greatest industrial nation depends solely upon our being able to find markets for our numerous manufactures and mineral products, and it is already our experience that as soon as another nation can supply a market with commodities manufactured of better quality, or more cheaply than we can, we lose our hold on that market, and our prosperity is correspondingly injured. To prevent this, we must continually improve and cheapen production. This is to be done by the introduction of economical labour-saving tools wherever possible, and by new inventions and discoveries, or by improvements on those existing. For all of these we are dependent upon our inventors and scientific men; it is therefore our interest to do our utmost to make their efforts easy, and to remove every unnecessary impediment from their way. The specialty of American invention is small labour-saving tools of every description and use. Their inventors can afford to pay a small Government charge of £7, but they cannot afford to pay anything like our expensive stamp duties in addition to the cost of preliminary experiments and trials.

An American patent once granted, lasts the full term of seventeen years without further taxation; whereas, as has been seen above, a British patent is subject to heavy taxes at the end of the third and seventh years. The result of these heavy taxes is that 70 per cent. of the British patents granted last only three years; 20 per cent. last only seven years; and only 10 or 11 per cent. last the full term of fourteen years. The average duration of a British patent is thus reduced to only five years against the American seventeen years. The number of patents actually granted in Great Britain is now about 3,500; whereas, the number granted in the United States is about four times as many. We can, therefore, scarcely be surprised that the Americans are looked upon as the most ingenious and practical of all nations; there invention is carefully encouraged and protected as the true and ever-acting cause of the nation's success. The theory on which patents are granted in the United States is the direct opposite to that ruling here. There the patentee is regarded as benefiting the nation to a large degree, and himself only to a small degree; but here he is most frequently looked upon as a hateful monopolist to be got rid of as soon as possible. Our experience in finding the Americans so frequently underselling us in our own markets, and the fact that they are seriously encroaching upon our standard industries proves their theory to be the correct one. As the prosperity and commercial supremacy of this country are dependent upon its manufactures and products, it behoves us to remove every obstacle to their being improved and cheapened; and it is evident that we have in our excessive stamp duties on patents one of the most serious obstacles possible, but which can, however, be easily removed by simple remedial legislation. With this object the following scale of reduced stamp duties has been proposed by Mr. John Standfield:—

Duration of Patent, 21 Years, including Provisional Protection for 1 Year.

On application (to cover cost of provisional protection) ..	£2
On filing final specification (to cover cost of printing).. ..	3
Total stamp duties on the grant of a patent.. ..	£5

To meet the objection that on the American system many practically dead and useless patents are kept in force, to the supposed hindrance of others who wish to make further improvements, Mr. Standfield proposes that there should be an annual tax of £1, which should become due every 1st of January, so that the patentee should not have the risk of losing his patent by forgetting to make the annual payment on or before the exact date of the grant of the patent. This proposed tax of £1 would be sufficient to cause the abandonment of useless and so-called frivolous patents, and would at the same time more than pay the expenses of the Patent Office. This office should, of course, be self-supporting, but should not, on any principle of justice, be a revenue-producing department of the State, as any revenue produced by it is the result of a special tax on one particular class—viz., the inventors. Such special class taxation is altogether repugnant to the principles of political economy. At the present time our Patent Office produces a net profit of about £145,000 per annum, which is thus a tax on the very seeds of our national prosperity. The whole of this sum is obtained from our inventors and scientific men, on whom alone we are dependent for our ability to hold the chief place among the commercial and manufacturing nations. The United States' Patent Office produces a net profit annually of about £35,000, notwithstanding the fact that their stamp duties are only 1-25th of ours, and that their expenses are nearly three times as great as ours. In consequence of this profit, the American Patent Commissioner officially proposes to reduce the present low tax of £7 for an American patent on the ground that it is unnecessarily profitable, and, therefore, unjustly high. By the adoption of Mr. Standfield's proposal, the number of patents annually granted would be multiplied manifold. Each patent lasting the full term of twenty-one years would pay £26, which sum would cover the cost of a strict technical examination as regards novelty of the invention, and would leave a very handsome balance for the sustentation of the finest and most complete Patent Museum and Library in the world.—*Journal of the National Chamber of Trade.*

LECTURES ON WATCH AND CLOCK MAKING,

PREPARATORY FOR THE ELEMENTARY EXAMINATION OF THE CITY AND GUILDS OF LONDON INSTITUTE IN MAY, 1881.

Delivered at St. Thomas Charterhouse School by I. Herrmann, on Monday Evenings from October 25th.*

(*Continued from page* 115.)

The Inclined Plane.

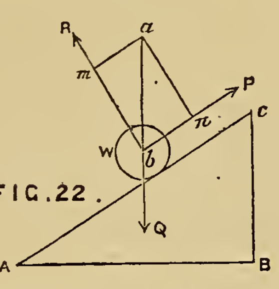


FIG. 22.

Let W, fig. 22, represent a ball, kept in equilibrium on an inclined plane C A B by a power P. Here we have three forces acting on the point or centre b: the weight W, in the direction of b Q, the power P, parallel to the plane A C, and the reaction R perpendicular to A C.

If we produce Q b to a, and represent W or Q by $a\ b$, draw $a\ m$ parallel to A C, and $a\ n$ to b R, then $b\ n$ represents the resolved part of $b\ a$ acting parallel to A C, and $b\ m$ or $a\ n$ the resolved part of $b\ a$ acting perpendicular to the plane. The angle $b\ a\ n$ is in all respects similar to C A B, that is—

$$a\,b : a\,n :: \text{A C} : \text{A B}$$

also $$a\,b : b\,n :: \text{A C} : \text{C B}$$

hence $$\text{P} : \text{W} :: \text{C B} : \text{A C}$$

$$\text{P} : \text{R or pressure} :: \text{B C} : \text{A B}$$

$$\text{R or pressure} : \text{W} :: \text{A B} : \text{A C}$$

The Movable Inclined Plane, or Wedge.

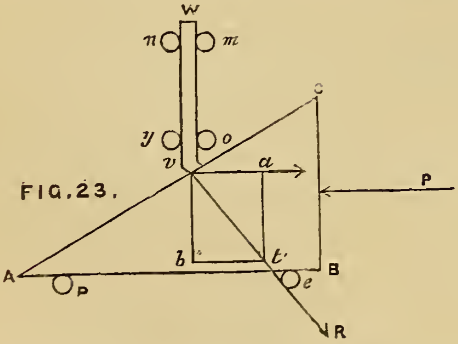


FIG. 23.

Let C A B, fig. 23, represent an inclined plane or wedge resting and movable on $c\ e'$. W is a weight movable in a vertical direction between the guides $n\ m\ y\ o$. The tendency of W is therefore to force C A B in the direction of P, which is acting against C B and keeping C A B in equilibrium.

Here the weight W is resolved into reaction or pressure on the plane A C, and a force acting parallel to the base.

Let $v\ b$ represent the magnitude and direction of W, and v R the direction of the reaction on A C draw $b\ t$, and complete the parallelogram $v\ a\ b\ t$, then $v\ a$ represents the power P, $v\ b$ the weight W, and $v\ t$ the pressure on the plane A C.

Again $$v\,a : a\,t :: \text{C B} : \text{A B}$$

and $$v\,a : v\,t :: \text{B C} : \text{A C}$$

hence $$\text{P} : \text{W} :: \text{B C} : \text{A B}$$

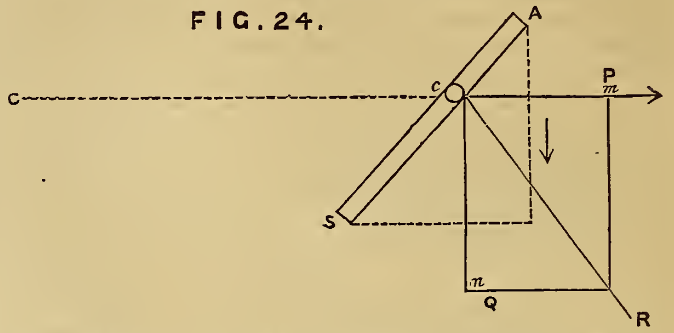
and $$\text{P} : \text{pressure} :: \text{B C} : \text{A C}$$

$$p : \text{W} :: \text{A C} : \text{A B}$$

To make the problem as simple as possible we have neglected friction. Practically, therefore, we should have to modify the result by multiplying it with the coefficient of friction according to the material employed.

Application to the Barrel Arrangement as Shown in Fig 19.

FIG. 24.



Let S A, fig. 24, represent the slot, and c the pivots, movable between S and A; then C c is the virtual lever arm. Let P represent the force of the mainspring exerted in the direction c P, and c Q, the force exerted at right angles to its radius C c, and let R equal the reaction on S A; then if we construct the parallelogram $c\ m\ r\ n$, $c\ m$ represents the resolved part of R available in moving c from A to S, and $c\ n$ the resolved part of R available to move c from S to A. Hence $c\ m$ represents the pressure on the coil of the spring and forms the equalising principle in this arrangement. It will be seen that if we diminish the angle A c C, $c\ m$ increases, and therefore the pressure; indeed as the angle approximates to a right angle the ratio of $c\ n$ to $c\ m$ becomes so small that the force of the spring is kept in equilibrium by pressure.

The friction on S A is very great, hence the wear, specially as the cover and bottom of barrel are necessarily thin. The wear that the pressure on S A will produce, makes the motion of c very soon irregular, hence this arrangement also is objectionable and impracticable.

The "Train."

By "train" we imply a system of wheels and pinions which connect the motive power with the escapement. This section of a clock or watch has a double object, viz., the increase or change in the ratio of relative rotary velocity, and transmission of force from the prime mover to the escapement.

We shall treat the first principle under the term of "calculations of trains," and the second under "proportions."

Calculations of Trains.

The employment of "teeth" and "leaves" is not a primary object, but rather an expediency, and only in the application of trains to the purpose of our second division, namely, "transmission of force," do they become a necessity.

If two discs, movable about their own centres, are in contact at their circumferences, motion may be communicated from one to the other, provided that the resistance of the wheel to be driven does not exceed the coefficient of friction

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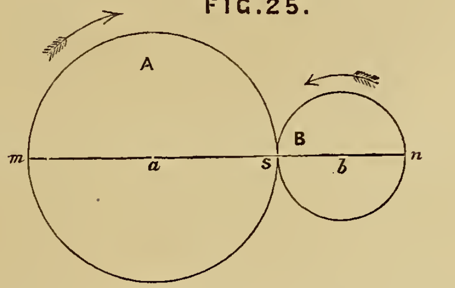
multiplied by the pressure at the point of contact with the driver. Where these are nearly equal, or where the wheel driven has to drive a third, and this in its turn a fourth, and so on, the resistance of the follower is increased, and becoming in excess of circumferential friction, slipping and sliding will result.

To prevent this occurrence, forms of indentations and projections are used or resorted to, which we call teeth and leaves. The conditions of their forms, relative dimensions and positions will be treated under our second sub-division, that is as far as an elementary course will allow; for the present we will only deal with those conditions which affect the rotary motion of wheels in relation to their drivers or followers, the prime mover, and the number of pendulum oscillations or balance vibrations.

In the case quoted, where motion is communicated by one disc to another, their respective velocities or angular motions are in an inverse ratio to their circumferences, or what is synonymous, their diameters or radii. It is this ratio that forms the basis for the relative numbers of the teeth in a wheel to the number of leaves in a pinion.

FIG.25.



Let A and B, fig. 25, represent two discs or wheels without teeth, movable about their centres, a and b, and in contact at s. Then if A is moved from left to right, B will rotate from right to left.

Let the diameter $s\ n$ of B = 1, and diameter $m\ s$ of A = 2, then the circumference of B—

$$= 3{\cdot}1416 \times 1 = 3{\cdot}1416$$

and that of A—

$$= 3{\cdot}1416 \times 2 = 6{\cdot}2832$$

Therefore B must rotate twice to one of A, hence, circumference of B : circumference of A : : $s\,n : s\,m :: b\,n : a\,m$.

Again, any given point in B moves through 2 × 360°, whereas any corresponding point in A only moves through 360° $\therefore$ The angular motion of B : A : : $m\,s : n\,s :: a\,s : b\,s$.

If now a number of teeth are placed on A and B in such a manner that those on A : to those on B : : $a\,s : b\,s$, then we shall obtain or maintain the same ratio of angular or rotary velocity as we had with the discs of these respective dimensions. The circles represented by A and B would form the pitch circles, and the effective part of the teeth of the driver A would originate at the pitch circle, that is, the circumference of A, and so lay wholly outside it, and the effective part of the indentation would lay within the circumference of B, or within its pitch circle.

The ratio of each driver and follower, in a system of wheels and pinions, is a factor in a sum represented by the number of rotations of the last follower in relation to the first driver.

Examples and Application.

The centre wheel of a watch or clock is always taken as a unit of motion, that is, whatever the number of rotations of any other may be, this wheel must make one turn in each hour (exceptions only in the case of flying motion works).

We will take the centre wheel and third wheel pinions separate, and find the number of rotations of the latter to one of the former.

Let 64 represent the number of teeth in the centre wheel, 8 = the number of leaves in the pinion, 1 = the number of rotations of the centre wheel, and x that of the pinion. We know from the text to fig. 25, that the rotations of the pinion : the rotations of the wheel : : number of teeth in the wheel : number of leaves in the pinion; hence—

$$8 : 64 :: 1 : x$$

and—

$$x = \frac{64 \times 1}{8}$$

$$x = 8$$

If we have any of these three quantities, we can always find the remainder.

Let x = the number of rotations of the centre wheel, then

$$64 : 8 :: 8 : x$$

$$x = \frac{8 \times 8}{64}$$

$$x = 1$$

Again, let number of leaves in pinion = x, then—

$$8 : 1 :: 64 : x$$

$$x = \frac{64 \times 1}{8}$$

$$x = 8$$

And, lastly, let number of teeth in the wheel = x, then—

$$1 : 8 :: 8 : x$$

$$x = \frac{8 \times 8}{1}$$

$$x = 64$$

The same holds good in any other set of wheels.

Thus in the third wheel and fourth pinion, we have number of teeth in the third wheel = 60, number of leaves in the fourth pinion = 8; then number of rotations of fourth wheel to one of the third (1)

$$= \frac{60}{8} = 7{\cdot}5$$

and the ratio of the number of rotations of the fourth wheel to one of the centre = the ratio of centre wheel and third wheel pinion × the ratio of third wheel and fourth wheel pinion

$$= 8 \times 7{\cdot}5$$

$$= 60$$

This can be collected into one statement, thus—

$$\left.\frac{\text{Centre wheel} \times \text{third wheel}}{\text{Third pinion} \times \text{fourth pinion}}\right\} = \left\{\begin{matrix}\text{number of rotations}\\ \text{of fourth wheel}\end{matrix}\right.$$

$$= \frac{64 \times 60}{8 \times 8} = 60$$

The rotations of the escape wheel in relation to the fourth or centre is found in the same way, and only involves the addition of a factor.

Let the number of teeth in the fourth wheel = 63, escape pinion = 7, all others remaining the same, the number of rotations of the escape wheel—

$$= \frac{64 \times 60 \times 63}{8 \times 8 \times 7} = 540$$

To find the number of pendulum or balance motions, we have simply to multiply this quantity by the number of escape wheel teeth, and that again by 2, there being two distinct motions of the balance or pendulum for every tooth in the escape wheel.

Thus let the number of teeth in the escape wheel = 15, number of balance vibrations = x, then—

$$x = \frac{64 \times 60 \times 63 \times 15 \times 2}{8 \times 8 \times 7}$$

$$= 8 \times 15 \times 9 \times 15$$

$$= 16200$$

If we know, or assume the number of balance or pendulum vibrations, we can determine any of these quantities that may be represented by x.

(*To be continued.*)

TRADE NOTES.

THE Melbourne *Argus* reports that jewellers earn at present from £2 15s. to £3 15s. per week, and that good tradesmen can get full employment; but the supply of watchmakers is said to be more than equal to the demand.

THE "Rhodes diamond," noticed in our last, was viewed last month by a distinguished party of ladies and gentlemen at Messrs. W. Ford & Co.'s steam lapidary works, 8 and 9, Clerkenwell Green, and, as may be expected, was greatly admired. The sum of £150,000 has been offered for the half-share, but no certain value can yet be put upon it.

ONE of our Society papers speaks of a dancing club to which only those are admissible who are proficient enough to be able to waltz up the ball-room without deviating from one plank, and then to perform the same feat "doing the reverse." The successful candidate is then supplied with a tiny silver slipper, which ladies wear as a brooch, and men as a trinket to their watch-chain. It is said that ladies who possess this badge never lack partners for a moment, but are in constant request, and "seldom remain long single." We should not be surprised if a lively demand arose for brooches in the shape of silver slippers after this; anyhow, it is worthy the attention of our manufacturing jewellers, as silver slippers will certainly make better ornaments than silver pigs.

THE Goldsmiths' Company have made the following donations:—

City of London College	£100
King's College Hospital	100
Shipwrecked Fishermen and Mariners' Society	50
St. Stephen's Church, Wandsworth	50
Thames Church Mission	25
Home Teaching for the Blind	20
Pure Literature Society	20
Spitalfields Soup Kitchen	10

WALTER MASTERS, 39, was charged with stealing from the shop of Messrs. R. S. Garrard & Co., jewellers, of 25, Haymarket, London, a sapphire and diamond ring, valued at £315. The prisoner went into the shop and asked to be shown some expensive jewellery. He selected several rings, watches, and chains, and desired that an assistant should be sent with them to the Langham Hotel, in order that they might be shown to an aged lady, his mother, who, he said, was staying there. It was then noticed that one of the rings was missing, and after some altercation it was found in the prisoner's coat pocket. From statements made by the prosecuting solicitor it appears that this impudent thief paid similar visits to other West-end jewellers and with better success.

AT a meeting of the Goldsmiths' and Silversmiths' Free Trade Association, held at 12, Pall Mall East, on Saturday, Mr. Edward J. Watherston presiding, resolutions were passed expressing satisfaction that the question of the taxation of gold and silver plate was under consideration by the Government, and regretting that the Goldsmiths' Company proposed to take no step for insuring a "drawback" upon existing stocks. A resolution was also adopted, "That, seeing that the Goldsmiths' Company is chiefly composed of gentlemen in no way connected with the crafts, and thus having no interest in matters relating to their modern requirements, it is desirable that immediate efforts should be made by legislation to sever the compulsory connection at present prevailing between the company and the trades in precious metals."

THE mercantile failures in the United States during the past year were in number 4,735, with liabilities of about 66 millions of dollars. In 1879 there were 6,658, with 93 millions indebtedness. In 1878 10,478 *failures* with 234 *millions* liabilities! This may be called in Yankee parlance a regular "busting" year. The decrease since 1878 is certainly remarkable, and indicates a healthy condition of commerce.

A LECTURE was delivered last month at the British Horological Institute on "Cheap Patents and Prosperity." Although cheap patents do not necessarily imply "prosperity" there can be no doubt that a more reasonable patent law would stimulate and improve our manufacturing industries, and assist in securing that national prosperity we all have so much at heart. The charges, as at present, are certainly exorbitant, in very many cases prohibitory, and put us at a great disadvantage in comparison with other nations, especially the Americans, our most formidable rivals in the field of invention.

WE are glad to hear that the National Chamber of Trade has taken the question in hand, and we reproduce elsewhere a lucid article on "Reform of the Patent Laws," from the organ of that useful and energetic body, the *Journal of the National Chamber of Trade.*

FROM various sources we learn that there is a decided improvement in the Swiss watch trade, and prices have in consequence been considerably raised. The Federal Bureau of Statistics has issued a tableau showing the Swiss exports to the United States from 1864 to 1880. From the *Industriel Suisse* we reproduce this month some very interesting statistics, referring specially to the trade in watches and musical-boxes. They evidently prove that the Swiss have not yet been "driven out of the American market," as quantity and value have been gradually increasing since 1877. We may add that the statistics referred to were obtained from the American Consuls in Zurich, Bale, Geneva, and the Commercial Agency in St. Gall.

MR. CURZON, the able teacher of escapement making at the Horological Institute, read a most instructive paper on "The Lever Escapement, its Correct Principles and Common Faults," on Wednesday, the 16th ult., in the lecture room of the Institute.

THE watch manufacturers of Bienne (Switzerland) are now assembling every Tuesday at the Hotel Bielerhof for the purpose of transacting business. Our Swiss exchanges tell us that the first meeting on the 1st ult. was very successful, about 80 representatives of manufacturers from other places being present, and buyers from Austria, Germany, and England. Business was brisk in almost every grade of goods, and a single firm is said to have made a transaction of 3,000 silver watches. A simple dinner, with an address of welcome by the President of the Committee, served as introduction.

IT is gratifying to be able to record that the jewellery trade is gradually improving, and that there is every prospect of increased activity in Birmingham. It is reported that silver bracelets are at present being turned out at the rate of ten thousand a week. There are also indications of improved business in the silver and electro-plate trades, and more cheerful accounts are received from Sheffield.

THE custodianship of Her Majesty's gold pantry at Windsor Castle, just rendered vacant by the death of Mr. Goring, is an office of great trust, as may be inferred from the fact that when the Queen entertained the Emperor of Russia, shortly after the marriage of the Duke and Duchess of Edinburgh, gold plate to the value of some £2,000,000 is said to have been used. At a rough guess the Royal gold and silver services at Windsor Palace are probably worth about £3,000,000.

AT meetings held by watch manufacturers at Bienne and Neuchatel, it was decided to raise the average price of movements from 10 to 15 francs, and it is expected that the French manufacturers will follow suit. Heavy orders from Australia are in hand, with an increased demand for the United States.

CONSTRUCTION OF TIMEKEEPERS DELIVERED TO THE BOARD OF LONGITUDE, MARCH 7, 1805.

Earnshaw's Escapement.*

(Continued from page 105.)

With respect to the preference to be given to box above pocket timekeepers, the former appear the best for the following reasons: every watchmaker surely knows the influence of oil; if by its change it robs of its power a main-spring of the force of one pound, then a main-spring of one ounce must be sixteen times more affected by it. This is well known from the effect produced by the change of oil on pivot detents, when timekeepers are made of a large size, merely for the purpose of having a large and powerful main-spring to drag the works on through all impediments of oil and dirt; but, before this is done, it should be considered whether an evil is not likely to happen, viz., the evil of friction far greater than that of oil. There is a happy medium between these two evils. Whether the inventor has found out that happy medium or not he leaves to the judgment of every impartial man who may examine his timekeepers, in which he will not find cuttings and tearings in any part, or hardly be able to discover in the oldest of them the least trace or place marked on which the escapement has acted. Thus, then he thinks time and ocular demonstration will fix the wreath with him. It may be said that in avoiding this evil, friction, he is subject to the mischief from oil; he trusts that the regularity in going of his timekeepers overturns that argument. There are only certain degrees of force which metals and all other bodies can bear without tearing each other. As far as the bodies will resist this, go, but no farther; for when so much force is used as to cause the acting bodies to injure the surfaces of each other, or any one singly, the worst of all evils in timekeepers begins to be generated. His box timekeepers have nothing like the force of main-spring of some watches, yet they vibrate quite as far with a balance equally heavy; it is clear therefore that their force, though so much less, produces all the advantages by avoiding friction, without being influenced by the oil, as their steady going fully proves. A pocket timekeeper may go as well as a box one, but not generally so, and their going well principally depends on the goodness of the oil. Oil sometimes turns out so, as to shorten the vibrations of a pocket timekeeper half its usual quantity, and in a few months would nearly, if not quite, stop it. The effect on a box one would be trifling.

On account of the difficulty of making watches go the same in different positions, gimbals have been introduced, and when properly made they will have the desired effect.

The inventor has compared his escapement with Arnold's in the following manner:—

1. This escapement has more vibration from the same power than his.

2. This is in consequence of the balance being more detached than Arnold's, which is of great advantage, having thereby less friction in the action of scape.

3. Increase of friction destroys equality of motion, so necessary to determine the longitude; and as the same vibration can be obtained in this as in Arnold's, with less power, consequently there cannot be so much friction in it as in his.

4. Arnold's scape with pallet one-quarter diameter of wheel requires one-third of circle to clear it; this scape with pallet one-half diameter of wheel, requires only one-sixth of circle to clear it, which is only half the quantity of action Arnold's has; consequently, friction is by that means most considerably reduced, and the causes that would stop Arnold's watch would not affect this, which is doubly detached to his.

5. The causes which prevent these timekeepers from being so subject to stop as Arnold's, are, the difference in the shape of the pallet and scape-wheel teeth, and principally in the difference of their sizes; these differences in their sizes and shapes have done away that which the watchmakers had not before the least idea of.

6. This scape-wheel is locked on its extreme point, and unlocks in an easy manner, in a similar circle with the wheel. Arnold's is locked on the heel of the tooth and nearer the centre, and unlocks in opposition to the whole train of wheels, which are two great disadvantages.

There are persons who have still the weakness to assert to this very hour that the detents with pivots are better than the inventor's spring; to which he answers in the following manner:—Those pivots have friction in their action, the spring has none; the action in pivot-detents requires oil; that oil, when it thickens and becomes glutinous, robs the tender spring of the pivot-detents of its power; the wheel then is subject to pass two teeth, and impedes the motion of the balance, which frequently stops the watch. The trade could not follow the plans of Harrison and Mudge, because of their complexity; but they have with tolerable success followed the inventor's from its simplicity, which accords with the following demands of the Act of Parliament:—"provided that such method is generally practicable and useful."

Therefore, however well their watches may go, it is doing honour to and proving the excellence and practicability of his inventions.

The best train for timekeepers is ...	18,000
Scape-wheel of pocket ones	15 teeth.
Box one	13 ,,

Everything else in the inventor's timekeepers is well known to watchmakers. He has made and sent about one thousand of them into the world, many of them have been constantly employed in conducting the most valuable part of the commerce of this country in safety, and preserving his majesty's ships and subjects from rocks, sands, and lee shores: and thus by the perseverance of his life to preserve others, he has greatly injured his health. And if, instead of this, he had turned his attention to the line of fashion and fancy in his profession, he would have avoided that evil, and been able long since to have retired with a handsome fortune.

The Board of Longitude, for the information of the public, and previous to their making a final award of recompense, were desirous of obtaining the most complete information on the construction and principles of the timekeepers in question; they therefore put several questions to the inventor, on such points as appeared capable of further elucidation. These questions, with the answers made to them, we here subjoin, as they will afford information which may be useful. In the original some confusion arises by incorrect references to the pages; but we have endeavoured to adapt the references to these pages in the manner intended:—

Q. Are you describing a box or pocket timekeeper? What should be the respective sizes of the pivots of the balance-axis for each?

A. The whole of my specification is on box-timekeepers, for the determination of the longitude; I have nothing to do with inferior articles, which pocket-watches are; but I have no objection whatever to give the fullest explanation on them. Therefore, the size for pivots of balance-axis for box-timekeepers is as I have before described it in my specification, viz., about the size of the verge pivots of a good common-sized pocket-watch. The pocket-timekeeper is a very little smaller. No description can be given that the trade are so well acquainted with as this.

(To be continued.)

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* Earnshaw's own description from "Smith's Compendium of Practical Inventions." Liverpool, 1816.

ON THE FLUCTUATIONS IN THE RELATIVE VALUES OF SILVER AND GOLD, WITH SPECIAL REGARD TO THE PRESENT DEPRECIATION OF SILVER IN INDIA.*

By Edward J. Watherston.

(*Continued from page* 102.)

SOME very interesting evidence on the question, How far silver is used for manufacturing purposes, was given before the Select Committee by Mr. Ernest Seyd. He gave it as his decided opinion, based upon carefully collected statistics, that the consumption of silver in manufactures, so far from rising with the increase of wealth and of population, had greatly fallen off in the course of sixty years. "In 1810," Mr. Seyd stated, "we consumed 1,171,000 ounces, while in 1871 we consumed only 598,000 ounces of silver." The following figures show the great decrease in the manufacture and export of silver plate in the quinquennial periods of 1855-59 and 1875-79:—

Year ending March 31	Weight on which Duty was paid	Weight on which Draw-back was allowed	Year ending March 31	Weight on which Duty was paid	Weight on which Draw-back was allowed
	oz.	oz.		oz.	oz.
1855	994,360	156,440	1875	886,493	120,280
1856	863,453	129,453	1876	870,507	104,612
1857	930,707	141,840	1877	798,206	109,262
1858	863,440	166,147	1878	783,151	83,345
1859	801,680	116,146	1879	740,239	85,121

A further serious decline is shown by the returns to March 31, 1880, viz. to 638,620 ounces: the exports show some improvement, viz., to 94,493.

When further questioned as to the relative amounts of silver used in England and in France for manufacturing purposes, Mr. Seyd told the committee that "in this country we use more electro-plate than in France, but in France the consumption of solid articles is larger," the reason being that "in this country legislative wisdom has thought fit to tax heavily "solid articles," but to exempt electro-plate altogether from taxation." As regards the coinage of gold and silver in England, Mr. Seyd stated that "from the year 1816, when gold was made the exclusive legal currency, until the end of 1875, there were issued from the Mint £234,139,886 in gold, and £24,663,309 in silver. There were coined, besides, in the Australian colonies, £35,857,000 in gold, being legal currency in England, and no silver whatever." In these few figures alone there lies abundant explanation as to why recent years should have witnessed an enormous depreciation of silver.

Of all the witnesses called before the House of Commons Committee of 1876 to give evidence on the subject of the depreciation of silver, perhaps the most notable was Mr. Walter Bagehot, since deceased, a man of uncommon grasp of mind, able to throw light upon any subject which he set himself to investigate. In a few striking words, Mr. Bagehot illustrated the folly of our legislature having "demonetised" silver, and thereby reduced its value. "The effects," he said, "extended not only to India, but to all countries which have a silver currency. These countries are the great majority of the world. The circulation of silver in these countries is something enormous, and to all those countries you will have to send a certain amount, if the depreciation of silver continue. The quotations of prices in all these countries are made in silver. Traders with these countries have to go through the operation both ways as to exports and imports, as I have described, in silver. As to all these countries, there will be a bounty on importing into them, and a discouragement in exporting from them, and in consequence there will be a flow of silver." More striking still were the words uttered by Mr. Bagehot, in reply to a question of Mr. Goschen, as to whether he had "calculated the surface covered by what is called the silver valuation with that which is covered by the gold valuation." The answer was most distinct: "Silver," Mr. Bagehot exclaimed, "is the normal currency of the world, and from a natural cause, because silver is a much cheaper metal, and is suited to those small transactions which constitute the bulk of the dealings of mankind." In these words, indeed, the eminent political economist—whose loss all England has reason to deplore—"hit," as the saying is, "the nail on the head." There can be no doubt whatever that "silver is the normal currency of the world," and that even in the two only countries where the so-called gold standard prevails there are millions who never see a gold coin in all their lives. On this ground alone it was a supreme act of folly on the part of our legislature to "demonetise" silver. Of the bitter results we have not yet seen the end.

The report of the Select Committee of the House of Commons, appointed to investigate the causes of the depreciation of silver, was like the reports of most parliamentary committees, very meagre, and on the whole very disappointing. It told nothing new, and suggested nothing. It was stated in the report, with unction, as if relating to some great discovery, that the chief reason of the depreciation in the value of silver compared with gold, was that there had taken place "changes in the use of the metals; gold had come more generally into use than before, and the condition of trade, and the situation of various countries using gold and silver respectively, had entirely changed." Not a word was said about the evident cause, "why gold had come more generally into use," that of its being employed extensively for coinage, to the exclusion of silver, the latter metal being relegated to serve, not as intrinsically valuable currency, but as mere "token." Equally, if not more, unsatisfactory, was what the Committee's report said about the uses of silver for manufacturing purposes. The report simply stated that the Committee "did not pursue this subject into any detail, as it appeared that the total quantities in question used in Europe were comparatively too small to exercise much influence on the market, in comparison with the immense operations connected with the use of silver as a circulating medium." The report added, not without a touch of cynicism, "how far the duty of 1s. 6d. per ounce on silver plate, whether manufactured abroad or at home, interferes with the manufacture of silver is an open question which your Committee did not pursue." One would have thought it clear to the meanest understanding, and not at all "an open question," that an enormous tax such as that of 1s. 6d. per ounce, irrespective of the burthen of "hall-marking," must necessarily, and must greatly, interfere with the consumption of silver for manufacturing purposes. And in this respect the report contradicted itself, for, further on, it said that "the great consumption of silver plate in the United Kingdom is among the higher, but in Germany, as well as in France, it is among the lower classes. The German peasantry, for instance, are in the habit of collecting a certain amount of silver spoons which they treat as dowries for their daughters."

(*To be continued.*)

A polish on tortoise-shell or ivory is produced by rubbing the article with oxide of tin dissolved in oil or water. Rub with a piece of flannel, and gradually work dry.

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* A paper read at the Social Science Congress, Edinburgh.

BRONZES.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 120.)

In the Christian museum of the Vatican are two bronze medallions, on which are represented heads of St. Peter and St. Paul facing each other. They are reported to have been found in the Callixtan catacombs, and thought to have a fair claim as early portraits of those Apostles. During the reign of Constantine basilicas were rapidly built and richly furnished with altars of wood covered with silver and canopied by a *baldacchino* ; on these were crosses and statues formed of the precious metals and adorned with gems and jewels. Gilt bronze sarcophagi lined with silver were made, to contain the bodies of St. Peter and St. Paul. The high altar in St. Peter's basilica was cased in silver and gold, and was surmounted by a jewelled cross, in weight 130 pounds of gold; the choir paved with the former metal, while golden statues of the Saviour and of some of the Apostles stood around, and lamps of the precious metals burned continually. The basilica of St. Paul was similarly enriched, and the wealth of the churches in ornamental and sacramental vessels was, according to Anastasius, enormous.

Nor was the love of splendour confined to sacred purposes, for during the reign of the first Christian emperor, the members of the imperial family, followed by the wealthy of the land, were extravagant in the use of the precious metals and jewels for the adornment of their houses and their persons with rich stuffs and richer ornaments. Metal work was greatly encouraged, and as St. John Chrysostom complained, the goldsmith's was the office most highly esteemed.

Works in gilded bronze naturally took their place when the more valuable metals were deemed unnecessary, or their semblance sufficed. But of all these little or nothing is left to us, and we can only judge of the comparative rudeness of the art from sculptured bas-reliefs, for the most part on sarcophagi of the period, and representing Christian together with typical subjects from the Old Testament history.

In metal-work we have a few spoons and pateræ of silver, the remarkable sacramental ewers or cruets of the fourth century now preserved in the Vatican, the casket of silver found with other objects on the Esquiline in 1793, and now in the British Museum, some silver objects in the possession of Mr. Franks, and others in various collections. Bronze lamps, curious in symbolic form, or ornamented with crosses and other emblems of the faith, have been found in the catacombs and elsewhere, several of which are in the Christian Museum at the Vatican, in the Uffizii at Florence, and in the British Museum ; one, extremely well wrought, in the form of a fish, and probably of earlier date, is in the writer's collection, as also a remarkable set of sacramental vessels found in Upper Egypt. These are of the earlier years of the seventh century.

The most important work in bronze sculpture which has descended from those days to ours is the seated statue of St. Peter, in that saint's basilica at Rome, a work ordered by Leo I. Its general aspect is that of a senatorial iconic statue, a work of the fifth century, and unusually good for the debased art of that period; not wanting in a certain rigid dignity, and remarkable for technical skill and finish, which would corroborate the opinion, supported by a Greek inscription which existed on the original marble chair in which the figure was seated (now replaced by a bronze chair of the fifteenth century), that it may be the work of a Byzantine artist. An important gilt bronze work, ascribed to the seventh century, is the chair or throne of Dagobert (so called) at Paris, of which an electro-deposit copy is in the South Kensington Museum. It is not, however, all of the same period, the lower portion being probably ancient, while the upper is an addition of more recent time.

We ought not to forget the fact that under Constans II., during his visit of twelve days to Rome in 663, the removal of all bronze and many other works of art considered worthy was accomplished by that fratricide emperor, who then finally robbed the eternal city of her chiefest remaining works of art. Among these (according to Nibby) were the statue of Trajan and the gilt bronze tiles which covered the dome of the Pantheon ; all were shipped for Constantinople, but lost, by shipwreck or by Saracenic spoliation.

At Byzantium, where the processes of various arts had been preserved, a great work in bronze was executed by order of the Emperor Justinian in the year 543. This was a column covered with plates of that metal, and surmounted by a colossal equestrian figure of the emperor, some thirty feet in height, also of bronze. It is remarkable that the artist, Eustathius, is said to have been a Roman, from which, perhaps, we may infer that the plastic art was still superior in that city. This column, although ruined, was not melted down till the sixteenth century. Another important work, which is thought by Mr. Perkins and other authorities to represent the Emperor Heraclius, and to have been cast at Constantinople by a Greek artist named Polyphobus, in the seventh century, is the colossal bronze statue now standing at Barletta, in Apulia. Giovanbatista Finati, on the contrary, judging from comparison with the coins of the two emperors, concludes that it is intended for Theodosius the Great, and a work of the last quarter of the fourth century, with which period the Roman military dress and accoutrements would better agree. He wears a diadem of pearls in double row on his head ; in the right hand the cross is held aloft, and his gaze is heavenward. This statue, stranded upon the beach, was set up and restored by the Neapolitan bronzist, Albanus Fabius, in 1491. At Ravenna was the bronze equestrian statue of the Emperor Zeno, cast at Constantinople ; on his left arm was a shield, while his right hand held a lance.

The rigid formalism of Byzantine style, accompanied by great excellence of technical power, came like a returning wave and extinguished almost the last spark of the ancient classic manner. In the seventh century it had appeared in Italy, and was extending its influence and manner throughout the west, then fast sinking into comparative barbarism. But few plastic works of large size were produced, particularly in bronze, while on the other hand a careful execution and high finish of the details (such as rich ornaments of the dresses, thrones, &c., in Oriental taste) may be observed in the paintings and ivories of this period. The manner became stereotyped, and under the influence of the Eastern Church lasted almost unchanged in some countries for several succeeding centuries, in fact nearly to our own day, as may still be seen in modern works produced by the monks of Mount Athos. Many interesting lamps of terra-cotta and of bronze, adorned with early Christian symbols, ornaments, and figures in the Byzantine style, are preserved in museums. That of the Vatican is rich in examples ; some specimens are at Florence and in the British Museum. No. 578,—'72 at South Kensington may be instanced as a work of this character, but without emblems. Another in the same museum, of purely Byzantine character, though probably cast at a later period than its style might indicate, is the triptych, No. 1615,—'55 ; but whether originally modelled for casting in bronze or moulded from an ivory carving it would be difficult to feel assured.

(*To be continued.*)

THE DIAMOND FIELDS OF GRIQUALAND WEST.

By R. W. Murray.[*]

THE South African Diamond Fields are one of the greatest, if not the greatest, wonders of modern times. The discovery of diamonds on the banks of the Vaal River, in 1868 and 1869, attracted thousands of colonists to that part of Griqualand West, and to the establishment in 1870 of the Hebron, Pniel, and Barkly Diggings, and afterwards to such other river diggings as Waldek's Plant, Cawood's Hope, etc., etc. Up to nearly the end of 1870 it had been concluded that diamond deposits were only to be looked for on the banks of that river, but before 1870 had closed it became known that diamonds had been found at Du Toits' Pan without washing out the diamondiferous soil, which was, during the early time of the river diggings, a most laborious operation. The river diggings were then almost abandoned, and diamond-searching was carried on for a long time at Du Toits' Pan on the dry-sorting system. During the year 1871 it was ascertained that there were diamonds in the Kopjes of Old De Beers and Bultfontein, and in July of that year the Colesberg Kopje (now the Kimberley Mine) was rushed, and the whole of the four before-mentioned diggings were for a long time worked on the dry-sorting system, and the *débris* thrown together in heaps outside the diggings and abandoned. In 1873, however, the diggers found that the abondoned *débris* contained almost as many diamonds as they had taken out of the diamondiferous soil whilst it was in their hands, and that it would be ruinous to continue the dry-sorting system, as one-half of the diamonds would be lost to them unless the soil when taken out of the claims was thoroughly saturated and washed out with water, as they had been accustomed to wash it out when digging on the river banks. When the Kimberly Mine and the Vooruitzigt estate, on which the Kimberley Mine is situated, were purchased from Messrs. Ebden and Co., the proprietors, by the Government, £10,000 was offered for the abandoned *débris* surrounding that mine alone, which offer was refused.

The diggers having ascertained that water was the great essential to successful diamond-searching, and the character of working claims having changed, at least six years since, from diamond-digging to mining for diamonds, new and more affective appliances than the cradles used at the river were invented, and wells were dug. It was also ascertained, when the light surface soil was passed, that the richer diamondiferous strata was of a rocky nature, and that this must be thoroughly saturated with water, and exposed to the sun, before it could be sufficiently crumbled for washing out in the rotary machine; and, from the time that strata has been the diamond-yielding material, the demand for water has been immense, and far greater than the supply.

In the last six years, at Kimberley, Old de Beers, Du Toits' Pan, and Bultfontein, diamond-mining has been a permanently settled industry, as is coal-mining in Newcastle, copper-mining in Cornwall, or tin-mining in Devon. It was estimated long since that there was invested in claims, plant, and steam machinery, in the before-mentioned four mining centres, over twelve millions sterling (£12,000,000), and Messrs. Robey, Ransome, and Sims, and other engine and machine manufacturers, are sending out first-class engines and machinery by mail steamers, and are never without orders in course of execution. There are no investments so much sought after as those which the diamond-fields offer, and the value of claims has increased more during the last year than in any other year of the existence of the diamond-fields.

The claimholders consider that when the Kimberley Water Company shall have made the water supply sufficient and regular, their returns will be so much larger as to greatly add to the value of their claim properties, which they, since the last Act of the Griqualand West Legislature, hold on fixed property titles, instead of on monthly license as heretofore.

In no season does the present water supply approach the demand for mining operations and town consumption. The rainfalls are confined to but a few months of the year only, and, subject as the country is to periodical droughts (which, during the ten years of the diamond fields, have covered half the period of their existence), the wells dry up, and mining operations are occasionally brought to a standstill.

From the Vaal River only can a sufficient supply of water for miners and householders be obtained. Water must be had by the miners at whatever price is demanded by well proprietors, as the suspension of mining operations is utter ruin. The claimholders, by such suspension, would lose all their native labour, and when once the natives are thrown out of employ, they leave for their homes, many of which are from 1,000 to 1,200 miles distant. The costly establishments must be kept up, license money must be paid to Government, and rates to the mining boards, whether the claims are worked or not, and all this in addition to the loss on dormant capital invested, which is very great, seeing that many of the claims of 30 feet by 30 are of the value of from £5,000 to £10,000 each.

Water has for years never been obtainable for less than 2s. 6d. for about 100 gallons, and in times of drought it averages 5s.

Since the establishment of the mines, fine, large, permanently settled towns have grown round the mining centres, churches of all denominations, with accommodation equal to those in the older towns, have been built, and others are in course of building. The Customs' duties paid on imported articles of consumption in the fields has been estimated by the Secretary of State for the Colonies to be at least one-third of the whole amount received at the colonial ports; over one million and a-half is paid for land carriage from the port towns to the fields; the trade done in Kimberley, Du Toits' Pan, Old de Beers, and Bultfontein is larger and more brisk than in any towns of the same size in South Africa, and four banks have been established, and they do a very large and lucrative business.

During the last seven years the mines have afforded employment to 650,000 natives, at an average wage, in money and kind, of 22s. per week. There are never less than 16,000 natives at work in the mines in addition to white labour, and the annual municipal revenue administered by the Town Council, chiefly obtainable by a rate of 3d. in the £ on the value of house property, is upwards of £25,000.

That the diamond mines are destined to be permanently the greatest wealth-producing power of the country, has been ascertained by experiments of various kinds; and the shafting which has taken place proves that depth does not abate the yield of diamonds; and that the deeper the digging the better the quality, as those who have had experience in the Kimberley and other mines can affirm. The building trade flourishes more and more every year, as stores and residences are now built of brick and stone, and the great proportion of merchants, traders, and mechanics have made their homes, and settled down with their families, in the towns.

Sir Bartle Frere, at a banquet given in his honour at Kimberley this year, in speaking of the great progess, wealth, and importance of that place, said:—"Even if diamonds failed to-morrow, which they certainly will not do, Kimberley will always be a large, wealthy, and important town, it being the centre of the great interior trade of South Africa."

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[*] Extract from the "*South African,*" published in the *Journal of the Society of Arts.*

Since that time the London and South African Exploration Company have laid out a new town of great size on the Kimberley side of Du Toits' Pan, and not only has every building site been taken up, but already handsome stores and residences of brick and stone are in course of erection there, whilst Bultfontein has extended itself up to the boundaries of Du Toits' Pan.

The diamond fields are now part and parcel of the Cape Colony, which as the returns of the Crown agents show, is one of the wealthiest and most progressive of all her Majesty's colonial dependencies, and the 4½ per cent. debentures recently issued for the annexation of Griqualand West to the Colony were placed at £102 to £103.

INDUSTRIAL TRAINING.

By an Old Technologist.*

THIS subject is now, under two distinct points of view, drawing the attention of the general public. On the one hand, taking account of the steady growth of foreign competition† backed and fostered by protectionist laws, we ask what are our chances of making head against a number of rivals, all literally hungering and thirsting for the overthrow of our industrial prosperity? Superiority in every branch of manufacture has become for us a question almost of life and death, but many ugly facts seem to show that we have lost not a few of those attributes on which our old reputation was based.

Turning, on the other hand, in a direction apparently quite different, we find that a growing proportion of our people, especially of the rising generation, shrink from manual labour, and prefer the precarious and wretchedly paid career of the clerk to that of the artisan. These two elements of our national position have not escaped the notice of thoughtful men. Still, believing that the last word has not yet been said, I venture to offer a few observations on the subject.

I am far from supposing that the twin evils which I have mentioned are solely due to any one agency. But among their many causes there is one which is deeply connected with both; I mean the nature of our industrial training, or the manner in which a practical knowledge and a mastery of any useful art has to be obtained. That manner or that process fails, on the one hand, to answer the purpose inintended, and on the other hand it keeps aloof many who would otherwise be well fitted for an industrial career. I mean the system of apprenticeship, which has been handed down from the dark ages, and which, though corrupt in itself and quite out of harmony with the times, is recognised by the law, and is enforced by a power which is above the law. The leading features of this institution scarcely need mentioning. Even in its palmiest days it was objectionable, because the pupil was during the course of his training reduced to the position of a serf or a bondsman. The master might be unwilling or unable to teach fully and truly the "art and mystery" to be learnt. The apprentice might, on further experience, find that his own qualifications, bodily or mental, were ill-adapted for the business which he had selected. Yet the tie could only be broken, if at all, at great cost and trouble. Custom has blinded us to the impolicy as well as the injustice of these features, but what should we think of a college which no pupil could leave until his education was complete? A farther drawback was the fixed term of years—generally the mystic number seven—imposed alike upon the industrious and idle, upon the lad of parts and the dullard.

In the lapse of ages, however, all the good features of the system have melted away, all the defects have remained and become increased, and certain fresh faults have sprung up. In the olden time the master, who was always personally and practically acquainted with his trade, did, as a rule, give the apprentice thorough instruction in every feature and point thereof. If the latter from dulness or sloth did not profit thereby, the fault and the loss were his own. Again, in most of the cities of Europe, the young craftsman when "out of his time" underwent a kind of test examination before experienced members of the guild. If he was found incompetent, the mere fact of his having gone through the form of apprenticeship did not entitle him to set up in business as a master. The long term of years was also not without its justification. The master contracted to board, lodge, and clothe the apprentice, and as the fee—when one was paid at all—was moderate, equity required that he should have the benefit of the services of the latter for some time after they had become valuable. Such was the apprenticeship in the days of yore—an institution far from faultless, but perhaps the best that could in those days be carried out, and deserving credit for having trained generation after generation of thorough workmen who took a pride in the quality of their handiwork.

The causes which led to to the entire corruption of the system have been fully shown elsewhere, and I will therefore pass at once to its present state. Of its main features there survive merely the legal binding for a fixed term of years, the state of serfdom, and the initial fee, which often reaches to a heavy sum. The personal supervision and instruction on the part of the master have entirely ceased; the youth is turned loose into the workshop, and may, if he is sharp enough, pick up more or less of the details of the trade. But no one feels personally responsible for his thorough training. Managers, foremen, experienced workmen, *even if willing*, have not time to give him the necessary instruction, and too often they are not even willing. If they are in possession of any especial trade secret they will not communicate it. It generally happens that in every branch of trade there are certain departments easier than the rest. The apprentice, instead of acquiring a complete knowledge of the whole business, is kept almost exclusively to these easy branches. I have known cases where young men have thus been completely mistrained, and on reaching the end of their term have found that they had their work to begin again.

The moral supervision of the old times has also disappeared no less completely than the industrial guidance, and has given place to systematic initiation in wrong-doing. Among the earlier tasks imposed upon an apprentice in many establishments are to fetch beer or spirits into the workshops contrary to orders, or to watch less the men are surprised by the manager when engaged in some piece of peculation or doing work on their own account with the master's materials. A lesson never omitted in certain trades is to instil into the novice the necessity of wasting the greatest possible amount of time over every job. If a youth finds these and similar pieces of dishonesty repugnant to his principles, he is made to feel his serfdom in a variety of manners.

Another feature of old apprenticeship which has been blotted out is the final test of skill and proficiency. All persons who have regularly "served their time" are—in the spirit of British trades unionism—considered equal, and any master who should "call a spade a spade" to the extent of pronouncing an idler or a dolt incompetent would have to bear the consequences. Thus it may be said that modern apprenticeship utterly fails to do what it professes. To say the best of it, it is an initiatory farce which every youth must undergo before he can be allowed to learn a trade in earnest, at the grievious sacrifice of time, money, and moral principle.

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* In the *Journal of Science.*

† It is significant that a statesman of a modern type publicly expressed his pleasure that we had no longer the monopoly of the world's manufactures.

I may now ask who are the parties injured by the apprenticeship system as it now exists? The list is long and formidable. The *bonâ fide* manufacturer (in contradistinction to a class whom I may treat of below) is the first sufferer. He wants skilful, competent workmen, who feel some little pride in their work, and are not always trying how idle, careless, and wasteful they may be without the risk of dismissal. Such men he can rarely meet with. One of the first lessons which a youth learns on entering the workshop is that merit and demerit are paid at the same rate. He even finds that to excel either in the quantity or quality of his performances is to incur the active ill-will of many of his shopmates. To get through more than a certain amount of work in a given time is considered as a declaration of war against the slothful and the thoughtless. This formal organisation of inefficiency is not merely hurtful to the employer; it tells upon the consumer, who gets inferior articles for his money; it militates against our foreign trade; and if purchasers abroad find in every article of British make the stamp of carelessness and inferior workmanship, can we blame them if they send their orders henceforth to France, Germany, and America.

Not less deadly is the system to the really clever, industrious, and concientious workman. He is, according to our modern practice, a mere eyesore and a nuisance to his worthless companions. His very existence is a silent protest against their omissions and commissions.

But the heaviest, the most capital charge against apprenticeship, is that it divides the working classes (in the common acceptation of the term) into two sections, separated by an almost impassable boundary, allowing to the majority no prospect of rise according to merit, and consequently depriving them of all motive for exertion.

In many establishments there exist a small body of skilled hands—foremen over branches, etc.—and a large number of mere labourers. This is decidedly the case in the chemical and tinctorial establishments, which the writer has had the greatest opportunity of observing. Between these two classes there exists a gulf fully as wide as that which formerly in the British army separated the "officer and gentleman" from the mere private. Just as the officer held his superior position in virtue of purchase-money, so the foreman holds his rank and pay by reason of an apprenticeship premium. If he is attentive, steady, skilful, he may rise to be a manager, or at any rate his salary is sure to be increased. But for the labourer—the "slab," or "mule" as he is called—there is, under ordinary circumstances, no chance of promotion. Suppose that a labourer in a dye-works, by dint of care and attention, became as good a dyer as the foreman of his department, and could turn out, *e.g.*, Turkey-reds, unequalled in fire and fastness, would he ever be entrusted with the conduct of that department? Scarcely! It would be said, as it has been said times without end, "Oh, yes, he is a very useful sort of man in his way, but he has never served his time." This magical formula decides the question. It is scarcely in human nature for a man to aim at excellence when once he knows that his exertions will never command recognition. The consequence is that the labourer takes not a particle of interest in his work, goes mechanically through his round of duties, and obeys the foreman's orders literally. He has no interest in preventing waste or neglect; he cares not a straw for any mischief that takes place so long as he cannot be held personally responsible, and, as a matter of course, shuts his eyes to all those occasional incidents from which an earnest and thoughtful man might take hints for improvements and inventions. To me it seems exceedingly sad that a large number of the men employed in any of the arts or manufactures should be in such a position,—sad for themselves, sad for their employers, saddest in the end for the nation. Should not the motto for the first Napoleon, "A free career for talent," hold good in the workshop as decidedly as in the camp?

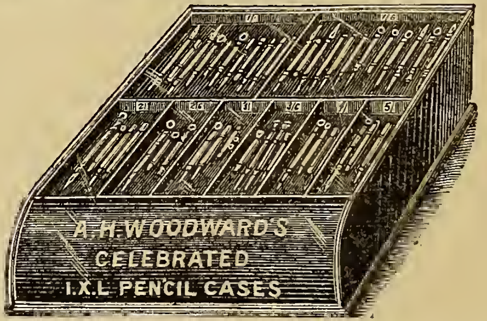
But we may turn to other trades. Among mechanical engineers there are also the two distinct classes; the skilled workmen, who have duly served their time, and the labourers. I could point to a certain establishment of this kind, not 100 miles from Manchester, where there was a labourer by common consent the cleverest man in the yard. If there was any piece of work of exceptional delicacy and difficulty it was placed in his hands. To all this the aristocracy of the trade graciously consented; but he might receive only a labourer's wages. The firm would have been only too glad to encourage him, and secure his services by paying him as a skilled mechanic. Had they made the attempt, however, it would have been voted treason against the sacred rights of apprenticeship, and a "strike" would have been at once declared. It may be asked whether, by thus crushing native talent, we do not fearfully handicap ourselves in our rivalry with foreign nations. Unless I am completely misinformed, American manufacturers do not care one straw when, where, or how a clever workman has acquired his skill. The American workman, too, seeks to rise in the world rather by bringing out some useful invention than by enforcing such old traditional distinctions in the workshop. Such, then, is the influence of apprenticeship upon the artizan.

(*To be continued.*)

DUTY ON SILVER PLATE.

We hear from an authoritative source that the duty on silver plate will be abolished at a very early date, probably before this present number leaves the press.

Aluminium Pen and Pencil Cases.—About two years ago we introduced "Woodward's" pencil cases to our readers, and from the practicability, elegance, and cheapness of the specimen then submitted to us we predicted a large sale for them. Our prediction has become true, the trade has almost universally endorsed our opinion, and Woodward's pen and pencil cases are a commercial success. We have just had an opportunity of inspecting a variety of new patterns, all distinguished by the simplicity of action, elegance of design, and beauty of finish so characteristic of the productions of this manufacturer. Superior finished ebonised cases are now also supplied by the firm in various sizes, containing a selection of their cases, so as to secure an attractive display for the latter. We can thoroughly recommend the goods, and those who do not keep this line already should send a sample order to Mr. A. H. Woodward, Vittoria Street, Birmingham.



THE
WATCHMAKER
JEWELLER.
AND
SILVERSMITH'S
TRADE
JOURNAL.
W H TILBY

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

Entered at Stationers' Hall.—Registered for Transmission Abroad.

CONTENTS.

	PAGE
The Application of Hand Work	139
Compulsory Hall-Marking	140
Machine Work *versus* Hand Work (A Reply to James U. Poole)	141
Awards at the Melbourne International Exhibition	142
The Construction of a Simple but Mechanically Perfect Watch	143
Practical Instructions to Jewellers, Silversmiths and Electro-platers	144
Repairing Swiss Watches..	145
Lectures on Watch and Clock Making ..	146
Trade Notes	148
Taxation of Gold and Silver Plate ..	149
On the Fluctuations in the Relative Values of Silver and Gold, with Special Regard to the Present Depreciation of Silver in India	150
Bronzes	151
Construction of Timekeepers Delivered to the Board of Longitude, March 7, 1805..	152
The Manufacture of Jewellery in Pforzheim, Germany	152
Industrial Training	153
The Discrimination and Artistic Use of Precious Stones	154
Hardy's Patent Safety Case	i
Bills of Sale	ii
Patents	iii
Monthly Record of Bankruptcies	iv
Directory	vi
Advertisements	i—xvi

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THE APPLICATION OF HAND WORK.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—I have already intimated that I considered it essential for a springer and timer to be thoroughly acquainted with the art of escapement making, but there are many other points in a watch which call for an equal knowledge of finishing, and in most manufactories where any number of watches are turned out, an experienced finisher fits the movements in the cases and is responsible for the mainspring being free in the barrel and the correctness of the stopwork, freedoms, depths, &c., leaving the escapement to the more delicate manipulation of the springer, who ought to make a preliminary examination before the watch is put together. It is but rarely that an escapement is found to be quite correct at the last, and a common cause of alteration arises from the inferior steady pins put in by many movement makers, which few escapement makers take the trouble to alter, although it is an axiom in good work to start with a proper foundation, and if the balance staff and escape wheel are thoroughly upright before the pallet staff holes are put in, any subsequent derangement is easily rectified.

[Since writing the preceding paragraph I have read the excellent remarks of Mr. Grossmann on steady pins, in your last issue, page 126, par. 83; most best English movements are steady pinned on that plan.]

Returning to the subject of springing, the first thing a springer should acquaint himself with, is the strength of the mainspring; in a fuzee watch, this is obliged to be regulated by the strength of the chain, a point which is often overlooked. The quality of chains has unfortunately degenerated of late years, and the disrepute into which fuzee watches have fallen in certain quarters has arisen, in a great measure, from this fact. If the balance is considered by the springer to be too light, he should apply a strong pendulum spring and bring it to time by adding additional screws, frequently platina, or, if too heavy, the screws should be reduced and one or two pairs removed.

The next point which is essential to the proper adjustment of a watch is, that the pendulum collett should fit properly and be well made. The pendulum collett arbor of the balance staff must be slightly the largest in the centre so as to allow the collett to press nicely down. If it fits too tight there is great danger of bending the balance arm or of setting the rim out of truth in taking it off, which may have to be done several times during the process of adjustment. A collett should never be squeezed up to make it fit; it is a mischievous proceeding, causing annoyance to every one who attempts to handle it. After the collett is made the balance is "cut," an operation usually performed by the balance makers, who make a distinct branch of it, although in the olden time it was done by the springer. I once saw the late Mr. Earnshaw cut a balance, and perhaps a sketch of his *modus operandi* may be interesting, primitive as it will no doubt be considered by some of my critics.

He first removed the screws from the balance, and placed them before him, in a straight line, in holes on his bench, then with a narrow file cut through the rim close to the opposite sides of the arm. This caused the rim to slightly fly open and its circular form was restored by placing it over hollows of varying depth filed in a piece of boxwood, and lightly rubbing it with a piece of metal inside. After testing the truth in the callipers, Mr. Earnshaw put the balance in an escapement box, and held it over the gas in order to "set it"; the tendency of a compensation balance is to slightly "set inwards" after being tried in the oven, causing an alteration of rate, and long experience enabled him to so leave the rim that the heat he subjected it to should bring it true. The screws were then replaced, with a regard to the thickness of the rim and its consistency. If it was stout and stubborn the screws were put forward towards the cutting, but if, on the contrary, it was light and springy, they were kept towards the back. At the same time the balance was carefully poised, either by shifting the screws from side to side or by reducing those which required it. It then was handed over to the springer, and by far the larger number of watches sold with compensation balances received no further adjustment. The springer brought the watch to time by taking up or letting out the spring, and contented himself by getting the hanging and lying positions pretty equal. The model adjuster I have in my mind's eye would however proceed in a very different manner. First the spring would be pinned in, in "equal turns," that is the points where it is pinned to the collett and stud should be at right angles to the cock; if the angle is less than a right angle, the watch will certainly go slow in positions or *vice versâ*, the last being the best fault. Assuming that the watch is going a little too fast, it is brought to time by adding a pair of screws of the requisite weight and then tried in the oven. Here let me remark that the principle of the action of the compensation balance is directly opposite to the popular notion of the expansion and contraction of metals, which are known to expand in heat and contract in cold, whereas a balance becomes smaller in the one and larger in the other; this is owing to the varying powers of expansion and contraction of the two metals of which the rim is composed, it being one-third steel and two-thirds brass, the ratio of expansion of the latter being greater than the former, or in the proportion of 3 to 2.

The *pendulum spring* is affected by all changes of temperature, becoming weaker in heat and stronger in cold, so that the balance "compensates" for the changes which take place in it.

The compensation is a task requiring great care and patience; not unfrequently small screws have to be substituted near the cutting, and the weight made up by placing another small pair behind; on the other hand I have known instances where balances have gone so slow in the heat, that platina screws have had to be substituted for gold, and the watch resprung in consequence. The compensation being at length considered correct, the spring is taken off and the balance very carefully poised; it is necessary to remark that no screws but the quarter screws should be touched after this operation, or it will require doing over again; of course it is most essential that the balance is perfectly well made and all the screws interchangeable. The spring is set true and flat, and the watch brought to time again by the quarter screws; the regulator should be left towards "fast" during the compensation in order to allow for what may be taken off in poising.

During the time that a watch is being timed in positions it should be carefully listened to at frequent intervals, and the arcs of vibration of the balance observed, for many irregularities arise from defects of construction, and cannot be overcome by the timing screws, in fact I consider that one of the chief advantages of putting a watch through the process of adjusting is the extra careful examination which it receives in consequence. A watch to be thoroughly manageable for adjusting should cross about one turn and a third lying and one turn hanging; the theory is, that the balance should be perfectly in poise and all corrections made by the spring and escapement, but the fact is, that only a very small percentage of watches will perform the same "all round," and the variations in certain positions must be counteracted by the screws.

I will for example sake presume that a watch is gaining 24 seconds in 24 hours lying, and going to time hanging, the balance being perfectly in poise; it should be tried for a few hours with the quarters downwards and equalised in these positions by turning out a screw on the side it is losing, and then tried again hanging and lying, when it will most likely lose about 9 seconds in 24 hours hanging and gain 15 lying. I should then turn out the lower screw one turn, and turn in the upper one half a turn, reducing the gaining lying to some 8 seconds, and bringing it to time hanging. It must be understood that I am speaking of a fuzee watch, with equal adjustments; the conditions of working on one with going barrel are altogether different. Having introduced the subject, I hope to continue it in your next issue, when I shall refer to other modes of springing and the examination of the pocket chronometer escapements.

I am, etc.

33, Spencer Street, Clerkenwell. James U. Poole.

COMPULSORY HALL-MARKING.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Dear Sir,—To save time in executing a colonial order for about 300 silver watches, "sterling silver cases, American fashion, not hall-marked," we made inquiry at Goldsmiths' Hall if it was permissible for us to make these cases at our case factory *here*, instead of ordering from Waltham.

We are informed the compulsory hall-marking features of the existing law will not admit of the work being done *in this country*. Consequently we are compelled to send the order to Waltham, and *English artisans are deprived of an order they are both anxious and ready to execute.*

This is not the first order of this kind we have received, and we are not overstating the case when we say we could make 4,000 or 5,000 watch-cases *here, this year,* to suit our colonial requirements; but compulsory hall-marking compels us to have them made at our American works. It is, perhaps, needless, but to avoid any misapprehension, we remark the cases required are, of course, *only* for our *own movements* manufactured at Waltham.

Whether we make these goods *here* or at Waltham is a matter of indifference to us, saving of time in executing this particular order only entering into the question, and that we can easily remedy in the future.

We thought, in view of recent meetings, so enthusiastic in support of the *compulsory* features of the existing law, the above facts would be of interest; and this question arises—If colonial buyers show preferences for American style of watchcases—which is evident from the fact of our exhibits at Melbourne receiving the first prize in art—may they not also show a preference for American plate? It is not improbable that orders will come to some English silversmiths for goods like American samples, and *not hall-marked,* which of course they will be compelled to decline. We are, dear Sir, yours truly,

Robbins & Appleton.

Waltham Buildings, Holborn Circus, 29th April, 1881.

MACHINE WORK *versus* HAND WORK.

A Reply to Mr. James U. Poole.

No. V.

(*Continued from page* 125.)

I NOW return to the topic broached at the close of my paper in March, and for the sake of connection will once more place Mr. Poole's golden sentence between inverted commas:—"While I write I have before me a gold pocket chronometer made by my grandfather sixty years ago, which is in perfect condition, and contains all its original parts, including the main spring" ! ! Two words will be sufficient to show the difference between an English watchmaker of the past and present time, *work, talk—awake, asleep.*

In order to make a relative estimate, we shall do well to glance at our country a hundred years ago. If we compare our home and export trade of to-day, and consider the many social advantages we possess which our forefathers had not, we shall see at a glance the high vantage ground on which we stand. They lived in a small country compared with the England of to-day, and in times of comparative barbarism. We live in an age and nation which are without parallel on the page of history, or the face of the earth, and yet we are among the first to show some of the worst signs of national decay. As the possessors of an illustrious ancestry, as critics of taste, connoisseurs of art, and the proprietors of a great mart, we may safely plume ourselves as the greatest horologists in the world; but considered as manufacturers of merchandise, we are among the least of our nation.

In the year 1714, several captains and owners of merchant vessels petitioned the House of Commons to consider the propriety of bringing in a bill to reward inventions for promoting the discovery of the longitude at sea. A committee was appointed to investigate the subject, and Sir Isaac Newton, when called upon for his opinion, made the following memorandum:—

"For determining the longitude at sea there have been several projects, true in theory, but difficult to execute.

"One is by a watch to keep time exactly, but, by reason of the motion of the ship, the variation of heat and cold, wet or dry, and the difference of gravity in different latitudes, such a watch hath not yet been made."

In the same year Mr. William Whiston, writing upon this subject, says:—"The method of obtaining longitude by clocks and watches, *though the easiest to understand and practice of all others*, has been so long in vain attempted at sea that we see little hopes of its great usefulness there; watches are so influenced by heat and cold, moisture and drought, and their small springs, wheels and pivots are so incapable of that degree of exactness which is here required, that we believe all wise men give up their hopes from them in this matter."

The Committee brought up their report on the 11th of June, and recommended that a Bill should be introduced into Parliament for the purpose of rewarding inventions or discoveries connected with the determination of the longitude. The Bill passed the House of Commons on the 3rd of July, and was agreed to by the Lords on the 8th of same month.*

It is unnecessary for me to give a detailed account of the labours of Harrison, Mudge, Arnold, and Earnshaw, to shew how completely they have set at rest the vexed question of finding longitude at sea. Nor is it necessary for me to add one word to shew how much they have contributed to the safety of those who "go down to the sea in ships," and to the wealth of our nation. Most nobly did they supply this much-felt want of their time, and to a great extent anticipate the requirements of our own, though in the very nature of the case it was not possible for them 100 years ago to make a watch suitable to the altered circumstances of to-day. They overcame the great difficulties of their time. We fail even to attempt to surmount the smaller ones of our own.

They are the wisest and best of men who first serve their generation, and then go to sleep. The great mistake of English watchmakers to day is that they have fallen asleep on the reputation of our grandfathers' chronometer. Speaking broadly, it is the business of each succeeding generation to take the treasures that its predecessors have rescued from the mine of science, and give them to all people; and if we are to be as successful watchmakers in the future as we have been in the past, we shall have to place the chronometric exactness of our forefathers in the most acceptable form within the reach of all.

Let us now carefully enquire into the causes of our failure:—

1st. We fail to make a suitable watch for the present market, and before we invest one shilling in machine tools we must first sit down and remodel our watch. In England to-day we cannot make a sound, sightly watch, at a saleable price. Instead of making a thick watch full of weakness, we shall have to make a moderately thin watch full of strength. We must unite a minimum of height with a maximum of power. Symmetry and strength should be united in the same watch, and not at variance as they are now in the English watch.

2nd. We fail through our neglect of going barrel and keyless work. Once for all I will confidently assert that when the exact man of science demands the utmost exactness that is attainable, there can be no doubt that the fuzee is superior to the going-barrel; but there is no difficulty in making a going-barrel watch to go within one minute per month, which proves it may be used with safety, not only for low class and medium quality of work, but for high class adjusted work also. Size and price considered, the going barrel is the strongest, simplest, cheapest, and therefore, the best motor. Every low-priced fuzee watch we make is a proof that we misunderstand the wants of the present markets.

3rd. We fail because we discourage improvements in our business. There are innumerable proofs for this statement, but I cannot do better than give the following quotation from the *Horological Journal* (Feb. 1878, p. 75), an extract from the speech of the chairman at the half-yearly meeting:—

"It was often said out of doors that the Institute was slow to render assistance and encouragement to inventions and improvements connected with the trade. He had heard this expressed in reference particularly to a gentleman who had introduced a new going-barrel keyless work, and improvements to the movement generally. If they identified themselves with a particular invention, which for the moment appeared advantageous, something more promising would probably turn up, and they would have ingloriously to retrace their steps."

To encourage one improvement which would speedily give place to another, would not have to be retraced as steps inglorious; on the contrary, they would be both glorious steps, and the sooner such steps are taken the better. I cannot withhold my regret that the pressure under which this statement was made comes from without, and not from within the walls of the Horological Institute. No greater boon could be conferred on English watchmaking to-day than some substantial improvements in keyless work, and the going-barrel movement generally.

The excessive stamp duties of an English patent preclude the possibility of a poor man participating in the profits of an invention, and there is, therefore, no incentive to exertions of this kind. Doubtless a cheap patent law would develope much latent talent for invention that exists among our workmen.

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* See Journals of the House of Commons, vol. 17, p. 677 to 716. Whiston's "Longitude discovered." London, 1714. "Life of Sir Isaac Newton."

4th. We fail because of our neglect of technical education. Of the early Methodist preachers, Mr. Wesley was wont to say, "They are orators by nature that owe nothing to education," and such may be said of the mechanical knowledge of most of us.

5th. We fail because of the wasted labour in the manufacture of our work.

It is agreed by all parties that hand work is most expensive, and yet we waste enormous amounts of skilled hand labour. I will give a few examples, confining my remarks to the centre wheel. When it comes from the movement maker it is invariably left too thick, sometimes it has to be reduced as much as one-fourth; and to keep the lower hole of the centre wheel as thick as possible, the rivets have to be reduced also, which loosens the centre wheel on the pinion, and it has to be re-riveted, an operation requiring much skill. The rim of the wheel generally, especially in best movements, is left too heavy; the inertia is for the most part in the rim of the wheel, and it should be reduced. The leaves of the pinion, which have been faced, i.e., polished, are left too high, not unfrequently a $\frac{1}{32}$ of an inch has to be turned off, which, if highly tempered, is a work of some little time, and cannot be turned as smooth as when it was soft, and so increases the work of refacing. The centre wheel holes are left too large, which have to be stopped up and drilled the proper size, and so cannot be made as sound as those that are sold in the plate. The reader may form some idea of the wasted labour in a movement when I tell him it is nearly all made twice over.

6th. We fail because of our neglect of machine tools. Remove from our business the defects and disadvantages under which it labours, and what is now a contemptible industry will become one of national importance.

In last month's issue of this Journal, Mr. Poole refers to a paragraph in which I combat his assertion that a chronometer escapement cannot be constructed by machinery, and he finds his views supported by Mr. Rigg, in his lecture before the Society of Arts, who, when he showed a chronometer detent, said it could not be made otherwise than by hand. It is a safe maxim that "the greater includes the less," and in my reply to Mr. Poole I have already shown that the work of the tool overcomes a *greater* difficulty in the pendulum spring than there is in the detent; and when we have overcome the great difficulties we need not trouble ourselves about smaller ones. Nevertheless, I will describe a process by which a detent can not only be made by machinery, but be made superior than by average hand work. To those of my readers who are familiar with a milling machine, a drilling machine, and a fine emery grinding machine, it will not be necessary for me to say one word; and those who are not acquainted with these tools, and yet interested in this controversy, will do well to visit a factory and see them used, and they will learn more in ten minutes than could be taught in the space of a hundred pages.

The process is briefly this: Take a piece of square steel, fix it in a milling machine, and with rotary cutters make the feet of two detents, and at the same operation cutting them off at the exact length. Then by a press tool make the oblong slot in the foot, finishing it with a drift. Then by a combination of cutters, make the blade and the arm on which the discharging spring rests. Fix it in a template, and in a drilling machine, drill the steady pin hole, the discharging spring, screw hole, and the hole for the detaining jewel. Then harden and temper. Finally fix it in the grinding machine, and polish every part of it, leaving the reducing of the spring for the last operation.

I have said it will be better made than by average hand work. The lines will be more accurately preserved, the drilling of the holes more perfectly upright, the exceeding squareness of the work will gladden your eyes, and, best of all, a spring by this process can be reduced more evenly.

The marvellous elasticity of the spring to which Mr. Poole has directed attention is due to its extreme thinness, which permits of it being left at a very high temper.

I sent to the Office of this Journal (where it can be viewed by those interested) a small spring taken from the chronograph work of a Waltham watch, which has been made by machinery, and sufficiently settles the question whether a detent can be made by machinery or not.

Further, not only can a chronometer detent be made by machinery and be made better than by hand, but I am inclined to believe that the introduction of machinery into this branch of our industry is eminently calculated to revive that which Mr. Poole has reason to deplore is fast becoming a lost art. If large quantities of this work were required, it is certain it can be made cheaper as well as better; and if we can only add to the excellence of our chronometer and diminish its cost, its power and influence for good have yet to be felt—its glory is yet to come.

The writer is not ignorant of the fact that whenever a handicraft is in danger of being taken away, there will always be found those that are ready to cry, from morning until night, "Great is this handicraft." The desire on the part of so many English watchmakers to limit the capacity of machine tools, and to over-estimate the importance of hand work, is the sickness which infects the life-blood of our enterprise. It is difficult, especially for an outsider, to realise the fact, but it is nevertheless true. A Nasmyth steam-hammer will deliver a crushing blow of many tons, and yet the self-same instrument will give a gentle tap sufficient only to crack the shell of a filbert nut. The machine tool is like the trunk of an elephant—it will tear up a tree by the roots, and yet it will pick up the finest needle.

RICHARD WHITTAKER.

(*To be continued.*)

AWARDS AT THE MELBOURNE INTERNATIONAL EXHIBITION.

FIRST CLASS.

Victor Kulberg, London, marine chronometers.
Collective Exhibits of Switzerland, watches.
American Watch Company, Waltham, watches.
ditto ditto ditto watch cases.
Chatwood Patent Safe and Lock Company (Limited), Bolton, safes.
Martin, Hall & Co., Sheffield, silver goods.

SECOND CLASS.

Kilpatrick & Co., London and Melbourne, pocket watches and chronometers.
Nicole, Nielson & Co., London, pocket watches and chronometers.
Lange & Sons, Dresden, Germany, pocket watches and chronometers.

THIRD CLASS.

D. Buckney, London, pocket watches and chronometers.
V. Kulberg, London, pocket watches.
Schäfer and Budenberg, Manchester, control watch.
Baume and Co., Geneva.

FOURTH CLASS.

Savoye Brothers, Besançon, France.
Besançon Company, ditto.

First class awards were also made to Gaunt, of Melbourne, for turret clocks, and S. Brocot, Paris, for French clocks.

THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.*

By M. Grossmann, Watch Manufacturer,
Glashuette (Saxony).

(*Continued from page* 127.)

84. Two steady pins, well adjusted, are quite sufficient, and much better than three pins made in the common careless way, with which a cock often goes on rather hard at the beginning, and allows some shake when close down to the plate.

The steady pins ought not to be too long, for if they are, they bend too easily. The length must not exceed double their thickness, and the pin wire must be drawn as hard as possible. To be effective, they must stand as far apart as the foot of the cock will allow of.

85. The balance is a part, the dimensions of which show very great variety in watches, and without undertaking here any dissertation on this subject, I will restrict myself to stating that I believe it a good proportion to multiply the diameter of the pillar plate with 0·4, or to take four tenths of it as the diameter of the balance. With a movement of 16-size, or 44 m., this would be 44 × 0·4 = 17·6 m.

86. If the movement is to have a compensation balance, great care must be taken to have ample space for the inside and outside of the rim. I have noticed many cases of inexperienced workmen being nearly driven to despair by a watch apparently in the most satisfactory state, and performing quite well, but at the beginning of the cold season stopping regularly every night. When being examined, of course, in a warm room, the watch resumed its ordinary march without showing the slightest disorder, till it was found out that the expansion of the balance brought it into contact with a cock or other part too near its circumference.

CHAPTER VIII.

The Casing.

87. The method of casing presents a variety of features, and necessarily varies according to the style of case; therefore in order to settle this point we must first decide on the best plan of case.

There is, first, the old English style of case, with a fixed dome, the hands to be set, and movement to be opened from the dial side. In this kind of case the movement is fixed at the twelve with a joint, and held in its place by a catch at the six, which for opening can be pushed in with the nail of the thumb. This method makes, undoubtedly, a good strong case, but it has many inconveniences for the wearer of the watch. For winding the case must be opened behind, and for setting the hands it requires to be opened on the dial side. A very bad feature of this arrangement is the opening of the movement by means of the catch—a slipping off from it of the nail of the thumb has caused the ruin of many a good seconds or minute hand. A case of this kind may be employed for a full-plate movement, in which, by its nature, the hands must be set on the dial side, but any three-quarter plate or bridge frame ought to have the setting square behind (70).

88. For this latter kind of watches the modern form of case will be the most convenient. The movement is fixed to the case by one steady pin and one or two screws, the latter being best. The Swiss watches generally have three pins driven into the edge of the pillar plate at some distance from each other. The middle one of those is the strongest and of a square shape, and partly enters into a small recess in the rim of the case, thereby preventing any circular displacement of the movement, and the outer end of it, filed sufficiently down from its upper side, takes hold under the rim as well as the two side pins. This mode of fixing the movement generally with only one screw is rather troublesome in putting in and taking out the movement, especially with the very thin cases of so many Swiss watches.

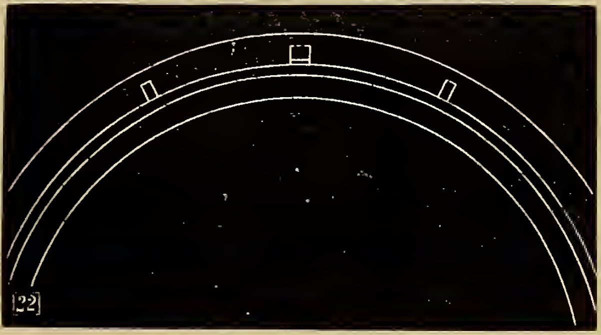

Fig. 25.

89. Therefore I propose another plan, which, if the pillar plate and its shoulder be properly fitted into the rim of the case, will answer completely, though of very simple and easy execution. A hole must be drilled through the upright part of the rim surrounding the pillar plate, into this plate. A pin driven into the hole in the plate, and shortened so as to enter into the rim without exceeding its outer side, serves at one and the same time to hold the movement down in its place, and to prevent any side displacement; two common key-screws, each 120°, or one-third of the circumference apart from the pin and from the other screw, and taking their hold on two studs soldered to the inside of the rim, complete the fastening.

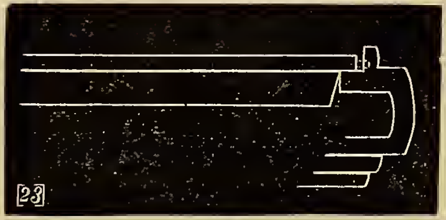

Fig. 26.

90. The pin ought to be always placed near the balance, so that this most precious and delicate part of the movement comes first into its position in the case, and is not exposed to any violence when forcing the movement down on its seat. It is very essential to adjust a movement carefully into the case, so that it enters quite smoothly and without any pressure, because in this latter case, especially if the case is strong, and the plate thin and not hard, it might easily suffer a deflection in a sufficient degree to alter the end shake of the pinions.

91. I would not recommend to have the key-screws for the casing in the upper plate and taking their hold outside on the rim of the case, because the plate is too thin to offer sufficient stock to the screw, and because this thin plate, if the screws are strongly turned in, is liable to bend. The pillars must then be considered as a fulcrum, and in the ratio, as the screws tend to lift the outer edge of the plate, the inner parts will bend down, and thus diminish the end shake of the pinions.

92. The movement in the modern case is accessible from behind by opening the dome, and as the hands are set from this side, the wearer of the watch has no occasion whatever to open the dial side of the case. In this kind of case the dial ought to be fixed with key-screws and not with pins, else it would not be possible to take it off without previously taking the movement out of the case.

(*To be continued.*)

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PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. ROSELEUR.

(Specially translated and revised for this Journal.)

No. XXV.

(*Continued from page* 129.)

RESISTS.—If it happens that the same watch part is composed of copper and steel, this latter metal requires to be preserved against the action of the cleansing acids and of the graining mixture by a composition called "resist." This consists in covering the pinions and other steel parts with a fatty composition, which is sufficiently hard to resist the tearing action of the bristle and wire brushes, and insoluble in the alkalies of the gilding bath. This preparation consists of—

Yellow wax, 2 ounces;
Translucent colophony, 3⅓ ounces;
Extra fine red sealing wax, 1½ ounces;
Impalpable peroxide of iron, or polishing rouge, 1 ounce.

Melt the colophony and sealing wax in a porcelain dish upon a water bath, and afterwards add the yellow wax. When the whole is thoroughly fluid, gradually add the rouge, and stir with a wooden or glass rod. Withdraw the heat, but continue the stirring until the mixture becomes solid, otherwise all the oxide of iron will fall to the bottom of the mixture. The flat parts to receive this resist are slightly heated and then covered with the mixture, which melts and is easily spread. For covering steel pinions employ a small gouge of copper or brass fixed to a wooden handle.

The metallic part of the gouge is heated upon an alcohol lamp, and a small quantity of resist is taken with it. The composition soon melts, and, by turning the tool around the steel pinion, becomes coated. Use a scratch-brush with long wires, as their flexibility prevents the removal of the composition. When the resist is to be removed after gilding, place the parts in warm oil or into tepid turpentine, then into a very hot soap water or alkaline solution, and lastly into fresh water. Scratch-brush and dry in warm sawdust of white wood. The holes of the pinions are cleaned and polished with small pieces of very soft white wood, the friction of which is sufficient to restore the primitive lustre. The gilding of parts composed of copper and steel requires the greatest care, as the slightest rust destroys their future usefulness. Should some gold deposit upon the steel, it should be removed by rubbing with a piece of wood and impalpable pumice-dust, tin putty, or rouge. Resists are also applied when it is desired to obtain gildings of several colours upon the same object, resists, generally made of some kind of varnish, are used. After having gilt an article of a uniform red or green colour, it is covered with a fat varnish, made drying by the addition of chromate of lead, at those places which are to resist the action of the new bath. By means of resists and successive baths, several different shades can be obtained upon the same object. The resist varnishes are applied with a brush or pencil, and should be thoroughly dried in a stove before placing the object into another solution. These varnishes may be coloured with various oxides or coloured salts, in order to facilitate their use upon those places which should be sharply marked; chromate of lead and artificial ultramarine blue are well suited for the purpose. Resist varnishes are also used for preserving the reverse parts of articles which have to receive the gilding only on the front. When the operation is finished, the resist is easily removed by a washing, first, with essence of turpentine, gasoline, benzine, or benzol, and then with alcohol. When benzol is used it is sufficient to wash the article in boiling water, and then to dry it in warm sawdust of firwood. It comes out perfectly clean. This is not always the case with rectified turpentine, and it may be necessary to plunge the object into a hot alkaline lye, then to rinse and dry it in warm sawdust.

GILDING.—After the preparations described, the gilding may be effected by some of the processes already mentioned. Hot baths cannot, of course, be employed for those pieces covered with the resist. Heat one-eighth of an ounce of finely laminated and pure gold in order to destroy all organic substances, dissolve in a glass flask with three-sixteenths of an ounce of pure nitric acid, and three-eighths of an ounce of pure hydrochloric acid. When the gold is dissolved, evaporate the excess of acids, leaving in the flask a syrupy dark red liquid; the whole is then removed from the fire and allowed to cool.

Dissolve the chloride of gold in about two ounces of distilled water, and pour into a large glass vessel. Dilute with about a pint of distilled water, and pour into the liquor a certain excess of pure ammonia which precipitates the gold in the state of a yellow powder of ammoniuret of gold, or fulminate of gold, which is a detonating powder when dry. The proportion of ammonia is sufficient when a new quantity of this reagent, being added to the clear liquid above the settled powder, does not produce any new precipitate. The clear liquor is decanted, and kept among the saved waste.

Collect the settled powder upon a small filter, previously wetted with distilled water; then wash with distilled water until all ammoniacal smell has disappeared. The filter and its contents are afterwards put into a glass or porcelain vessel with a quart of distilled water, and three-eighths of an ounce of pure cyanide of potassium, which rapidly destroys the gold, and passes through the filter. The whole is filtered again, boiled for 15 to 20 minutes, filtered again and left to cool. The bath obtained is excellent for gilding the most delicate watch parts, with an electric current regulated to suit the surfaces to be gilt. Several of these baths, in various degrees of exhaustion, are generally kept in flat-bottomed glass or porcelain vessels, and holding from 7 to 9 pints within a depth of 4 to 5 inches. The articles to be gilt are suspended to metallic holders, connected with the zinc pole of a battery, and of a shape appropriate to the nature and form of the watch parts. One or more platinum wires are used for anodes, and are disposed in the centre or round the bath.

The battery most generally employed by gilders of watch-work is composed of three, four, five or six small Daniell elements. Those with balloons, on account of their constancy, are, however, preferable. Smee cells, and still more so those of Bunsen, Grose, and Archereau, should be avoided, as their energy often produces too rapid deposits, and also because they lack constancy, and fill the workshop with quantities of acid fumes, which would alter any steel articles present in a few seconds. We repeat that the Léclanche battery is the best for this application. (This battery was fully described in our articles on batteries.) The slower the gilding operation is performed, the finer and the more adherent it is. When the coating is sufficient, all that remains to be done is to wash the articles in clean water, and fix again upon the cork in order to proceed to the last scratch-brushing with a decoction of liquorice, or of horse-chestnut.

(*To be continued.*)

REPAIRING SWISS WATCHES.

No. VII.

By H. Ganney.

(*Continued from page* 124.)

THE art of turning with the bow and common turns is so valuable to the watch repairer, that no opportunity should be lost by all young watchmakers of acquiring facility in this branch of the business, as advancing years render it almost impossible to atone for neglect of this subject in early youth. A certain amount of daily practice is the only sure means of acquiring it, and it was at one time the usual plan of teaching a youth his business to let him have at least two hours a day at turning, as the ordinary watch repairing business, unlike escapement making, and finishing of new work, does not give the opening for turning talent to be developed; and the supply of material now being so prevalent, instead of making new pieces as required, it behoves all having appprentices to make provision in this respect, by making the learner produce himself all screws, arbors, plugs, and stoppings, and rough out, for the other workmen, the pieces that they finish and put to the watches. The tools are so cheap and simple, that, failing other means, a youth may at home, as overtime, supply any deficiencies in this respect of his employers; and the spectacle,now too common, of young men who have served seven years and quite unable to replace a broken piece of watch-work would become rare. The usual routine of large and small clock-work to commence with, and finishing with coarse and fine watches, is admirably adapted to develop the mechanical ideas of the learner; but the turning must be supplemented with more than what is required ordinarily in the course of the business of watch repairing.

A few years ago it seemed English watchmakers had almost a monopoly of skill in fine turning, and a really good pivoted pinion was never seen on a Swiss watch; and a conical pivot unknown to them. The usual practice was to make the pivots on a Jacot lathe (very well as a recourse), but of the same value to a good pivoter as corks to a swimmer. Now we observe some very good pivoting in foreign work, for not only has the Swiss workman travelled abroad much, but he forms quite a large portion of the talent employed in all centres of watch production, and considering how readily the Swiss transfer their services to wherever there is a demand for watch-making talent, it does not seem that any deficiencies in English talent can fairly be said to account for the decline of watch-making in England, as a demand for talent would have been met with a corresponding supply.

The young talent now being developed in the trade is not being used at home, but emigrates as soon as competent; want of enterprise and ability to occupy his true position on the part of the watch manufacturer are the principal deficiencies. The microscopical character of watch-work, and its study and practice, are in themselves calculated to destroy the spirit of bold adventure and successful enterprise, and produces a certain amount of effeminacy, which requires a large amount of conntaracting influences. Almost any sort of turns will do good pivoting, the only requirement being rigidity of the centres when fixed, and firmness in the rest, which must be brought as close to the work as possible; and the centre that holds the pivot that is turning must be as close as possible to the hole in the turns. For this reason many pivoters prefer the plainest possible turns, with a piece of brass for a rest, having another piece of brass riveted on it, which is simply put against the turns, and the two screwed up in the vice, the work being brought close to the rest by the centres. This primitive and despised plan is better than using the ordinary Swiss turns, which being made to elongate, so as to take in all sizes of work common to the various jobs in use, is deficient in the prime element of rigidity, and the rest that usually accompanies them is three times the width it ought to be, and should be filed away to allow the shortest possible amount of centre to be used. When a long centre projects, the work invariably becomes loose, as the pressure on such a long lever is more than the binding screws can counteract. What are known as English pivoting turns, when the rest is shortened, answers all the requirements of fine turning, as the centres are held firm by the split hole, in which they fit, being closed throughout its length on the centre by a screw working from the back, and not liable to accidental disturbance by a touch in working, and all parts very strong and rigid. The centres usually supplied with turns are not of much use, as all the holes are made in the centre of the steel, and this prevents the work coming close to the rest, and renders good or fine turning impossible, besides breaking both fine graver points and pivots by the vibration of the graver. Ordinary round steel must be fitted rather loosely, or as dirt accumulates in the holes there will be an amount of force required in moving the centres difficult to apply and dangerous to the work in hand, as the centre must be moved lightly in all directions with one hand, whilst the work is held lightly in position for fixing with the other. The back centre must be a pointed one, with only one hole or chamfer in it, made with a fine punch, as near the outer edge of the steel, when full size, as convenient. The surrounding steel must all be filed away with a half round potence file, forming an irregular hollow cone for a quarter of an inch; this may be considered the finest or finishing back centre, and should have a hole in which the finest pivot point can rotate without side motion. The other end of the centre should be made a centre of the same kind, but much stouter and larger, to hold an arbor when the pinion is first commenced on for turning. The fine point to the centre is to allow it to pass freely up any ferrule in which the work is held, and all strength compatible with freedom should be obtained; and the hole of the centre being at the side or excentric, allows the work to be raised or lowered or brought close to the rest as may be desired, and also in a straight line with the holes in the other centre at which it is being turned. The right hand centre is simply left full size, and both ends filed quite flat, and small dots made round its extreme edge with a sharp punch completes the apparatus for turning. The ends of all centres should be made red hot and plunged in water; if hardened all over, they may break when dropped or pulled roughly. One or two holes, or dots, may be made so close to the edge as to burst, or a slight nick cut, in which the point of a pivot rests when being polished. As the various holes wear through they may be used for polishing pivots on, and holes that wear too deep and become dangerous thereby to the work by the friction they generate must be restored to use by grinding the centre on the oilstone. Many neglect to harden centres, but the advantages of hardening are very great—the friction is much less, and the constant wear and change of soft centres prevents the certainty and accumulation of experiences in the use of a tool which ensures perfection in such a delicate operation as fine turning. Another centre, called a centring one, is quickly made by filing the plain steel centre as a right angle on each side with its face, and cutting a recess on each side; an arbor or pinion point resting on it, exposing its extreme end, may be truly centred by a very smooth old file; a new one will have too much power over it, and push it off the centre. Great lightness and rapidity are necessary in centring truly.

(*To be continued.*)

LECTURES ON WATCH AND CLOCK MAKING,

PREPARATORY FOR THE ELEMENTARY EXAMINATION OF THE CITY AND GUILDS OF LONDON INSTITUTE IN MAY, 1881.

DELIVERED AT ST. THOMAS CHARTERHOUSE SCHOOL BY I. HERRMANN, ON MONDAY EVENINGS FROM OCTOBER 25TH.*

(*Continued from page* 131.)

Example.—Let third wheel = x, the other values remaining, we have—

$$16200 = \frac{64 \times x \times 63 \times 15 \times 2}{8 \times 8 \times 7}$$

$$x = \frac{16200}{\dfrac{64 \times 63 \times 15 \times 2}{8 \times 8 \times 7}}$$

$$x = \frac{16200 \times 8 \times 8 \times 7}{64 \times 63 \times 15 \times 2}$$

$$x = \frac{1620}{27}$$

$$= 60$$

Again, let the third wheel pinion = x, then—

$$16200 = \frac{64 \times 60 \times 63 \times 15 \times 2}{8 \times x \times 7}$$

$$\therefore x = \frac{64 \times 60 \times 63 \times 15 \times 2}{16200 \times 8 \times 7}$$

$$= 8$$

These formulas will give the value of any wheel or pinion represented by x.

If a wheel and pinion is lost, we have to represent the ratio of their numbers by x. Thus let the ratio of third wheel and fourth pinion = x, then—

$$16200 = \frac{64 \times 63 \times 15 \times 2}{8 \times 7} \times x$$

$$\therefore x = \frac{16200}{\dfrac{64 \times 63 \times 15 \times 2}{8 \times 7}}$$

$$x = \frac{16200 \times 8 \times 7}{64 \times 63 \times 15 \times 2}$$

$$= 7{\cdot}5$$

Hence, if we put 8 for the pinion, the wheel would be—

$$= 8 \times 7{\cdot}5 = 60$$

CONVERSION TRAINS.

The last example is directly applicable to conversion trains. If a verge watch has to be converted into a lever, the number of balance vibrations are assumed, and the number of escape wheel teeth being a standard number, only the ratio of fourth wheel and escape pinion are an unknown quantity; hence let this = x, and let the number of balance vibrations = 18000, centre wheel = 60, third wheel = 54, third pinion = 6, fourth pinion = 6, then—

$$18000 = \frac{60 \times 54 \times 15 \times 2}{6 \times 6} \times x$$

$$\therefore x = \frac{18000 \times 6 \times 6}{60 \times 54 \times 15 \times 2}$$

$$= 6{\cdot}66$$

In this case we get a repeating decimal, therefore we should have a fraction for a tooth to get this number of beats.

Hence we take the nearest integral number. Assuming a pinion of 8 for the escape pinion, the number of fourth wheel teeth would be = 8 × 6·66 = 53·28, taking 53 as the nearest integral number, we have for the number of vibrations—

$$= \frac{60 \times 54 \times 53 \times 15 \times 2}{6 \times 6 \times 8}$$

$$= 17887{\cdot}5$$

APPLICATION TO TIMING.

In watches with seconds or seconds trains, the method of rough timing or regulating is a short and easy process, but in any other than seconds trains, watchmakers experience some difficulty. In order to time a conversion quickly, it becomes necessary to know in how many seconds the fourth wheel makes one turn.

Example.—Take the last train given,* the number of rotations of the fourth wheel in one hour is—

$$= \frac{\text{Centre wheel} \times \text{third wheel}}{\text{Third pinion} \times \text{fourth pinion}}$$

$$= \frac{60 \times 54}{6 \times 6}$$

$$= 10 \times 9$$

$$= 90$$

The number of seconds in one hour = 60 × 60 = 3600; therefore the time in seconds of one rotation of the fourth wheel—

$$= \frac{3600}{90}$$

$$= 40$$

We can gather these separate items in one statement, thus:—Time in seconds of one turn of fourth wheel—

$$= \frac{3600}{\dfrac{60 \times 54}{6 \times 6}}$$

$$= \frac{3600 \times 6 \times 6}{60 \times 54}$$

$$= \frac{360}{9}$$

$$= 40$$

THE MOTION WORK.

The ratio of the number of rotations of the minute hand to the hour hand is always as 12 to 1; hence we have—

$$\frac{\text{hour wheel} \times \text{minute wheel}}{\text{Minute wheel nut} \times \text{cannon pinion}} = 12$$

Example.—Hour wheel = 42, minute wheel = 48, minute wheel nut = 14, cannon pinion = 12, then—

$$\frac{42 \times 48}{14 \times 12}$$

$$= 3 \times 4$$

$$= 12$$

If any of these quantities are lost or represented by x, they can easily be found.

Let cannon pinion equal = x, all others remaining, then—

$$12 = \frac{42 \times 48}{14 \times x}$$

$$\therefore x = \frac{\dfrac{42 \times 48}{14}}{12}$$

$$= \frac{42 \times 48}{14 \times 12}$$

$$= 3 \times 4$$

$$= 12$$

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* We have retained the same values in all these and following examples, in order to make their connections a means for the clearer understanding of each separate one.

Again, let hour wheel $= x$, then—

$$12 = \frac{x \times 48}{14 \times 12}$$

$$\therefore \quad x = \frac{14 \times 12}{\frac{48}{12}}$$

$$= \frac{14 \times 12 \times 12}{48}$$

$$= 42$$

Should the minute wheel and nut be lost, then we represent the ratio of the number of teeth to the number of leaves in the nut by x; and—

$$\frac{48}{12} \times x = 12$$

$$\therefore \quad x = \frac{12}{\frac{48}{12}}$$

$$= \frac{12 \times 12}{48}$$

$$= 3$$

Hence, if we take 14 for the minute wheel nut, the number of teeth in the minute wheel—

$$= 14 \times 3 = 42$$

Great Works.

We have seen that in trains the first wheel, viz., the centre wheel, forms the unit of motion, and in the motion or hand work the unit is formed by the ratio of the first and last movers, in this case the unit is the number of rotations of the last wheel in a given period.

In watches the centre wheel makes generally thirty rotations to one winding of the spring.

Again, great works of watches and clocks are either going barrel or fusee. In the going barrel watches with the Geneva stopwork, four turns of the barrel are available to obtain this product.

If then we put x for the ratio of the barrel and centre wheel pinion, we have—

$$30 = 4 \times x$$

$$\therefore \quad x = \frac{30}{4}$$

$$= 7{\cdot}5$$

Giving 10 as the number of the centre pinion, the number of barrel teeth—

$$= 10 \times 7{\cdot}5$$

$$= 75$$

Clocks with going barrels mostly go fourteen days = 336 hours, and have, with very few exceptions, intermediate wheels; therefore—

$$336 = \frac{\text{intermediate wheel} \times \text{barrel} \times \text{barrel turns}}{\text{centre pinion} \times \text{intermediate pinion}}$$

Taking the number of barrel turns $= x$, number of teeth = 100, number of intermediate teeth = 96, intermediate pinion = 14, centre pinion = 12, then—

$$336 = \frac{96 \times 100 \times x}{14 \times 12}$$

and—

$$x = \frac{336}{\frac{96 \times 100}{14 \times 12}}$$

$$= \frac{336 \times 14 \times 12}{96 \times 100}$$

$$= \frac{21 \times 7}{25}$$

$$= 5\ 88$$

In similar manner we can find any other value by representing it by x.

For fusees the same formulas hold good, that is, between the fusee and centre wheel. In most watches of modern construction, the fusee makes four turns, and the centre pinion has ten leaves, therefore we have the identical condition of the going barrel.

For clocks which go eight days, or 24 × 8 = 192 hours, we have different factors and ratios.

Example.—In an English dial the great wheel has 100 teeth, centre pinion 12, required the number of fusee turns. Let this number $= x$, then—

$$192 = \frac{100 \times x}{12}$$

and—

$$x = \frac{\frac{192}{100}}{12}$$

$$= \frac{192 \times 12}{100}$$

$$= 23{\cdot}04$$

In the case of fusee and barrel we have six quantities, viz., number of turns in the fusee, the length of chain determined by the fusee turns, its breadth, circumference of barrel, and number of barrel turns.

The minute investigation of all these points, and their several relations would lead us out of our course, hence we can only deal with round numbers.

To find the length of chain by the fusee we get the approximate value by taking the average diameter plus the breadth of chain, multiplied by the number of fusee turns.

Example.—Number of turns in the fuse = 4
Radius of first turn, = ·5
,, second turn = ·4
,, third turn = ·35
,, fourth turn = ·3

then the medium radius—

$$= \frac{{\cdot}5 + {\cdot}4 + 3{\cdot}5 + {\cdot}3}{4}$$

$$= {\cdot}3875$$

∴ Diameter = ·3875 × 2 = ·775, taking breadth of chain = ·1, its length—

$$= ({\cdot}775 + {\cdot}1) \times 3{\cdot}1416 \times 4$$

$$= {\cdot}875 \times 4 \times 3{\cdot}1416 = 10{\cdot}9956$$

The condition of length of chain and size of barrel, or number of turns to its given size, are identical with the examples worked on drums of clocks and length of line and fall of weight, hence to state them here would only be needless repetition.*

The conditions of length of mainspring to a given size of barrel and number of turns, form likewise questions which lay outside our present course, as it involves a process for which we are not prepared, and an amount of time which we have not at our command, having yet many other more important points to consider.

In the working of the various problems of number of vibrations, missing wheels, etc., we have taken for granted that the conditions which ensure the harmonious action of all the parts in question are realised. These conditions are synonymous with all others involved in the second object of clock and watch trains, viz., "transmission of forces from the prime motor to the escapement," which we will now consider as far as a first course will permit, under the term

Proportions.

By saying "as far as a first course will permit," I mean that there are so many sides to this subject that it will not be possible to analyse nearly all of them, hence we shall have to accept some on the faith exercised in legal practice, viz., "the authority of precedent," still we shall not do so without tracing them to their main consequences.

(*To be continued.*)

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* See page 98, vol. 6.

TRADE NOTES.

There is a Bill now before Parliament to give London the benefit of the pneumatic system of synchronising clocks—a scheme which has been so successful in Vienna and Paris. The Bill has the sanction of the City authorities and the Metropolitan Board of Works, and the promoters propose the establishment of ten controlling stations. The maximum charge for public clocks is not to exceed 12s. 6d. per annum.

At the Salford Borough Police-court, Thomas William Harrison, watchmaker, carrying on business at 8, Bridge Street, Manchester, was brought up, charged with stealing during the past two months a number of gold and silver watches, of the total value of about £150. Evidence was given by a number of gentlemen who had left their watches, which were in some cases very valuable ones, with the prisoner, in order that he might execute some repairs. It was stated that the prisoner, who was committed for trial, had been in the habit of pawning the watches at Manchester and Salford.

The shop of Mr. Davis, jeweller, 126, Tottenham Court Road, was broken into, and goods valued at between £1,000 and £2,000 were abstracted. It is supposed that the shop was entered while some of the assistants were engaged in closing the premises, and that the burglar or burglars concealed themselves until the household had retired for the night. Amongst the articles taken were 150 gold bracelets, 316 gold lockets, 1,450 fancy gold rings, 31 gold watches, and several chains. A reward of £300 has been offered.

The blue book recently issued, giving the return of joint-stock companies registered during 1878, 1879, and 1880, states in a note that a company was registered in 1869 with a nominal capital of *one hundred millions sterling*, but its paid-up capital never exceeded £200.

A loan exhibition of Spanish and Portuguese art will be held in the South Kensington Museum during the summer months.

Gold is reported to have been discovered in one of the northern provinces of Siam, and a very rich specimen is said to have been recently brought to Bangkok.

The plating company of Berlopton Lane Works, Stockton-on-Tees, have successfully plated with nickel three large cylinder covers for marine engines. The largest cover weighs nearly $1\frac{3}{4}$ tons, and is 6 ft. 6 in. in diameter.

Thomas Carlyle, in his will, states :—"I give my watch to my nephew, Thomas, the son of my brother, Alexander, 'Alick's Tom,' as a memorial of the affection I have for him, and of my thankful (and also hopeful) approval of all that I have ever got to know or surmise about him. He can understand that of all my outward possessions, this watch is become the dearest to me. It was given me on my wedding, by one who was herself invaluable to me; it had been her father's, made to her father's order; and had measured out into still more perfect punctuality his noble years of well-spent time; and now it has measured out (always punctually) nearly 47 years of mine, and still measures, as with an ever-loving solemnity, till time quite end with me; and may the new Thomas Carlyle fare not worse with it than his two predecessors have done." No wonder "the hater and exposer of shams" valued this watch, it was evidently a piece of that genuine work which he admired so much.

C. S. Peirce, according to the *Comptes Rendus*, has re-examined the estimates of the length of the second's pendulum at Paris, by Borda, Biot and Kater. He finds that if allowance is made for the inertia of the air, which is dragged by the friction of the pendulum, the estimated length should be increased about $\frac{1}{100}$ of 1 per cent. He therefore regards the true length as 993·934 millimetres (39·132 inches). Faye compliments Peirce's investigation very highly, and he congratulates the French Academy upon the great accuracy of the previous experiments, which were conducted largely under its auspices, when the facilities for minute measurements were not so great as they are now.

At the Building Exhibition held last month at the Agricultural Hall, Islington, we noticed various articles in a new alloy to imitate silver, called *arguroid*. The exhibitors, Messrs. Thomson, Sterne and Co., of Glasgow, supply it in ingots only, and prophesy that it will supersede all silver-plating and nickel-plating, as it does not lose its brilliancy. It has a very pleasing appearance, and if the surface remains permanent, as is claimed for it, this new alloy will certainly find extensive application.

Messrs. Potts and Sons, of Leeds, have erected a new clock at the Town Hall, Newbury.

Subscriptions are solicited for a memorial to the unfortunate Sir Louis Cavagnari. It is to take the shape of a clock tower, and peal of bells to be erected in the Municipal Garden at Kohat, on an elevated spot, whence the dial can be seen both from the city and cantonments. The movement was set on foot at Kohat, where Cavagnari had worked for several years as Deputy Commissioner.

The Scotch Members of Parliament presented Mr. Duncan M'Laren with a congratulatory address and an exceptionally handsome onyx casket in recognition of his long and admirable services in the house.

The Waltham Watch Company have recently introduced a handsome chronograph in gold case, fifth seconds, fly back and keyless, movement at back, front ordinary watch face. The specimen submitted to us is a solid and elegant instrument, costing from £25 to £30.

Robbing Jewellers.—A middle-aged man, who had personated a gentleman named Walter Masters, of Swansea, living at the Langham Hotel, was brought up on remand, before Mr. Mansfield, and charged with stealing a sapphire-and-diamond ring, valued at upwards of £300, from the shop of Garrard and Co., 25, Haymarket. Mr. Masters appeared in the witness-box, and said that the assumption of his name and address by the accused had led many persons to believe that he had committed this robbery. The evidence having been completed in the case, the prisoner, who pleaded guilty, was committed for trial upon it. Another case was then opened against him. On the 16th of March last he went into the shop of Hancock and Co., 39, Bruton street, and asked to be shown some jewellery for wedding presents. He could not, he said, absolutely decide upon any purchase without showing the articles to "the duchess, his wife." The shopman asked who she was, and the prisoner wrote down the name of a Portuguese duchess, who, he added, was living at the Alexandra Hotel. It was arranged that some sapphire-and-diamond crosses should be designed, and on the following day the prisoner came again, saw the crosses, and also examined some rings. With a number of these articles an assistant was afterwards sent to the hotel, but no duchess was to be found there, the hotel proprietor remarking that two other jewellers' assistants had called on the same errand. On the assistant's return the cases shown to the prisoner were examined, and it was then found that a diamond ring of the value of £100 had been stolen. On this charge the prisoner was remanded.

During the construction of an artesian well at Nievenheim, near Reuss, Germany, a large quantity of sand, containing innumerable particles of a glittering metallic substance, was thrown up. The proprietor of the land upon which this operation took place, a peasant-farmer, at first believed these particles to be gold-dust, and carried a bagful of the stuff to the laboratory for testing precious metals, established in Ehrenfeld under the direction of Professor Schmitz. There several small parcels of the sparkling sand were submitted to the usual tests, and were found to contain no atom of gold indeed, but from 30 to 38 per cent. of pure silver. The fortunate farmer, this result having been duly communicated to him, went on his way rejoicing, and upon his return to Nievenheim at once engaged a number of workmen to drive four shafts into the stratum of silver-containing sand underlying his property. He has since parted with one of them for the sum of two thousand six hundred pounds. In the opinion of the *Cologne Gazette*, this precious sand was washed down thousand of years ago, from the mineral hills of Commern and Mechernich. It forms a stratum about eighteen feet thick, lying some five yards beneath the surface of the earth, and, in all probability, contains an incalculable quantity of silver ore. Should this prove to be the case, Nevada will have found a redoubtable rival in Nievenheim.

Robinson *v.* Curry.—This action was brought in the Court of Appeal by the plaintiff, the deputy-warden of the Goldsmiths' Company, to recover penalties amounting in the aggregate to £6,430, from the defendant, a silversmith, of Great Sutton Street, Clerkenwell, for having sold 643 articles of silver bearing a spurious mark, the penalty for each offence £10. The defendant pleaded—firstly, that he had bought the articles from a well-known dealer in Islington, and had resold them in ignorance that the marks were forged; and secondly, that the plaintiffs could not maintain the action, as it had not been brought within the period specified by law—6, 8, and 9 Vic., c. 22, to amend the laws then in force on the marking of gold and silver wares in England. On this latter point the Court below, on an argument of demurrer, gave judgment for the defendant, and from this decision the Company now appealed.

Mr. A. Wills, Q.C., and Mr. Webster were counsel for the Goldsmiths' Company; Sir John Holker, Q.C., Mr. Crump, and Mr. Jones represented the defendant (the now respondent).

The Court were unanimously of opinion that the statutes did not apply in this case, as the plaintiffs were neither "common informers" nor "aggrieved persons" who could only bring actions respectively within one and two years. The company were not restricted as to the periods in which they could bring actions for penalties against persons infringing the law. The judgment of the Court below would therefore be reversed, with the costs of the demurrer and also of this appeal.

Up to the present it has been usual in Russia to control every imported article in gold or silver, and everything not up to standard was confiscated. The Russian law recognises only two gold and one silver standard, viz.—

18 carat gold indicated by the figure	72
14 ,, ,, ,,	56
875/000 Silver ,, ,,	84

Besides these figures, the articles are impressed with a Government stamp. There was, however, an exception in favour of watches, gold and silver, the control being optional, and this appears to have given rise to fraud. The confiding Russian public took for granted that the "three Imperial numbers" were always a safe indication of the quality of the watch cases bearing them, and did not trouble about the Government stamp at all, just as the British public buys (and is often taken in with) goods marked with an 18 for 18-carat gold, without reference to any other of the hieroglyphics intended as safeguards. This was the opportunity for some accommodating Swiss manufacturers. Nothing could be easier than to stamp either of the three numbers on the cases, quite irrespective of quality; and the game which had been carried on for a number of years must have proved nearly as profitable as the supply of "brown-paper" boots at the price of leather ones to the Russian army during the late war with Turkey.

TAXATION OF GOLD AND SILVER PLATE.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—Contrary to expectation, and most assuredly to the detriment of the trade, the duties upon gold and silver plate are not to be abolished this year. Disappointing as the decision of Her Majesty's Government is to those who have at heart the best interests of the trade, there is a gleam of sunshine in the conviction that we are entering upon the last year of a tax which stands condemned as a relic of a mistaken fiscal policy.

It is a sad reflection that it is not to be the first year of a new era of prosperity, but fate has ordained otherwise, and we must trust to time to prove the short-sightedness of those who have opposed a good and useful reform. There is nothing wonderful in recent events; history only repeats itself. Bright and Cobden had to work for years before they could get the House of Commons to see the policy of the reform they advocated. Manufacturers of bread offered the same opposition then as manufacturers of silver plate do now. The world is nearly half a century older, but human nature remains the same. Prejudice is as strong in 1881 as it was in 1831; but what is most astonishing is that working silversmiths take the view they do. It is sadly to be feared that in the course of the coming year they will have occasion to alter their opinion. That it must be a very bad year for them is certain, nothing else can be expected. The agitation for "total repeal" next year must now be renewed, and in view of such "total repeal," unaccompanied by any certainty of a drawback, the process of "stock-starving" will be continued. Very shortly the gentlemen who are responsible for this state of things will be told by the workmen—"Ye have brought us forth into this wilderness to kill this whole assembly with hunger." I do not envy the position of those gentlemen. "It often falls in course of common life, that right sometimes is overborne of wrong."

However, let not reformers be downcast; we are baulked—not beaten. Victory is certain in the end, and the triumph will be rendered the greater, when it comes, by the opposition which postponed it. One event of immense importance has occurred during the last few days. Goldsmiths' Hall has been opened to a meeting of the craft; let us make a note of the date of this remarkable event. We may some day, in the same place, refer to the "musty phrases" of various speakers, but, although it is a matter of regret that the object of the meeting was not more in harmony with the spirit of the times in which we are living, we cannot attach too great importance to the precedent established. The craft are to be congratulated, but more especially the Goldsmiths' Company.

We have now only to wait the issue of events. I am quite confident of ultimate success, for the very good reason that I firmly believe in the justice of my cause.

> "What is our duty here? To tend
> From good to better—thence to best;
> Grateful to drink life's cup—then bend
> Unmurmuring to our bed of rest;
> To pluck the flowers that round us blow,
> Scattering their fragrance as we go.
>
> And so to live, that when the sun
> Of our existence sinks in night,
> Memorials sweet of mercies done
> May shrine our name in memory's light;
> And the best seeds we scatter'd, bloom
> A hundred-fold in days to come."

I have the honour to be, Sir,
Your obedient Servant,
Edward J. Watherston.

Pall Mall East, London.
April 30th, 1881.

ON THE FLUCTUATIONS IN THE RELATIVE VALUES OF SILVER AND GOLD, WITH SPECIAL REGARD TO THE PRESENT DEPRECIATION OF SILVER IN INDIA.*

By Edward J. Watherston.

(*Continued from page* 134.)

CAN it be that the honourable members of the Select Committee intended this to be a sarcastic remark, that the tax on silver and the hall-marking imposition are maintained specially in this country in order that none but the children of rich parents should have the chance of being born "with a silver spoon in their mouths"? It is a most curious fact that, as well in the parliamentary inquiry of 1876 as in all other discussions on the depreciation of silver, in books, pamphlets, and newspapers, one momentous point, forming indeed the basis of all speculation on the subject, has been entirely left out of sight. The question is that of the actual "value" of both silver and gold. Suppose that mankind, who, from the earliest ages, made these two metals the principal mediums of exchange of natural and artificial productions, had, advised by their leaders, acted otherwise, and, for example, had selected iron and copper as the standards of value, and had used them as currency, what would have happened? Simply that iron, if not also copper, would now be far superior in value to gold and silver. It is beyond dispute that iron is, for pure human uses, and unconnected with an artificial currency, an infinitely more valuable metal than either gold or silver, and the very fact that it is far more useful than the latter has led to its being produced in so much greater abundance. It is only a few centuries since the production of iron—and its even more valuable offspring steel,—beginning in this country, extended to large dimensions all over the world. Now, if we imagine that the nations of the world, from the earliest dawn of civilisation, had adopted iron coins as a medium of exchange, the price of it might have been as artificially high as that of gold now is, and gold itself would have been comparatively valueless. Its beauty alone could not have made it valuable, for polished copper is nearly, if not quite, as beautiful. For most industrial purposes, such as the building of ships and of houses, gold is both too soft and too heavy, and it is on account of its softness utterly unfit to serve for those prime agents of all industry known as "tools." Silver, somewhat harder than gold, might perhaps have been adopted for some useful industrial purposes, but still would scarcely have been deemed of greater value than we now consider tin or zinc. Taking these simple facts into consideration, it must be admitted by all impartial reasoners that what is genearlly called the "intrinsic" value of gold and of silver has no existence in reality. We give gold what is called "value" in an entirely artificial manner, by setting it up as the principal medium of national and international exchange of goods. Until England set the example of "demonetising" silver, all the civilised nations gave such artificial value to two metals, and there was good reason for this being done. Of gold there is not enough to serve all the purposes of commerce, and there never has been enough, notwithstanding the large discoveries of modern times. These discoveries have been far from keeping pace with the prodigious growth of modern commerce, engendered by railways and steamers, and by the general progress of civilisation, together with the increase of population of all great states; and what was clearly required therefore was to increase the circulating currency, and not to decrease it. We deliberately choose to do the latter, in the face of the unalterable consequence of upsetting thereby the accounts of our dealings with over three quarters of the world's population.

It will have to be decided within the next few years whether silver shall be pressed down in value still further, perhaps ultimately not bearing a higher price than copper, or lead, or whether it shall resume its ancient value in respect to gold. At present the matter stands as follows: Only one important state in the world, Great Britain, has "demonetised" silver, and adopted the gold standard, followed by three of her colonies, namely, Australasia, the Canadian Dominion, and the Cape of Good Hope. All the other colonies, together with the Indian Empire, retain the silver standard as the sole legal currency. Nominally, a few other countries besides Great Britain, namely, the Argentine Republic, Brazil, Persia, Portugal, and Turkey, are under laws adopting the gold standard, but such legislation is practically effete, inasmuch as these countries have little or no metallic money of their own, and only foreign coins are in circulation. In Portugal, for example, where a law establishing the gold standard was passed in July, 1854, the curious fact prevails that since that date all home-coined gold has disappeared from circulation. The Mint was busy for a couple of years in coining numbers of golden "coroas," every one of which is said to have gone into the melting-pot, and the principal currency at present consists of French silver five-franc pieces and small silver "token" coins. In Brazil, where a gold standard was legally established in 1849, no gold is ever seen, and silver very rarely, the currency consisting almost entirely of greatly depreciated paper money. The same in the Argentine Republic, in Persia, and in Russia. Thus everywhere abroad an imposed gold standard, with accompanying "demonetisation" of silver, has been a complete failure. That it has been a failure in England is generally denied, but it would not be difficult to demonstrate—were it possible in this necessarily short paper to enter into lengthened discussion of such an important subject, illustrated by long files of statistics—that the "demonetisation" of silver by our legislature has been the cause of immense distress and of much of that decay of trade, home and foreign, ascribed to a variety of causes, even to sun-spots. Mr. Ernest Seyd, already mentioned, one of the ablest and most thoughtful investigators of all subjects connected with currency and exchanges, has no hesitation in affirming that the real origin of the depression of trade, which all are lamenting, lies in that we have, quite needlessly, and without any reasonable cause, contracted our limited and old-established currency by setting up the gold standard. He tersely remarks: * "The true cause of the abnormal depression of trade is the contraction of the currency by human law, the so-called 'demonetisation' of silver."

(*To be continued.*)

The Pearl Fisheries of Ceylon.—The banks of Aripo have lately been inspected by Captain Donnan, the master attendant of Colombo, who went to Silavatunai for that purpose. From the report of the fishery proceedings, it seems that there are about three-fifths of the original number of oysters in the beds still remaining to be fished, notwithstanding that the last season was prolonged to the first week in May, the last boat-load being landed on the 4th of May. With a view to induce a larger number of boats and divers to attend next season, their shares of the oysters fished have been increased by Government proclamation. It is thought that pearls of fine size will be obtained from the oysters remaining on the beds which have yet to be fished. In 1879 the proceeds of the year's pearl fishery were large, some seven millions of oysters being fished, and the sales realised about £6,000. The returns for 1880 are not as yet available.—*Journal of Applied Science.*

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* A paper read at the Social Science Congress, Edinburgh.

* Seyd (Ernest), "The Decline of Prosperity: its insidious Cause and obvious Remedy." London, 1879.

BRONZES.

By C. D. E. Fortnum, F.S.A.

(Continued from page 135.)

SOME of the most important works were made for the embellishment of the basilicas and churches, and in the form of reliquaries, church vessels, etc. Upon those a wealth of precious metals and stones was frequently bestowed. Of such are the altar-front of St. Ambrosio, at Milan, and of later date that of St. Mark's, Venice; the altar of the abbey church at Petershausen, near Constance, now destroyed; that of the cathedral at Basle, now in Paris; the altar-front at Aix-la-Chapelle, etc. The South Kensington Museum is rich in vessels for church use that will illustrate the metal-work of those centuries in gold and silver, and in gilded copper or *orichalcum*, adorned with enamel, with niello and with cabochon stones of the Byzantine and Byzantine-Romanesque and Gothic periods; these form the subject of another handbook.

From the tenth to the twelfth century sculpture was at a very low ebb, and large works produced between those periods are of great rarity. Ivory carving was practised, and the sculptor's art of these and succeeding ages is best represented in that material, a subject illustrated by Mr. Maskell in his introduction to the catalogue of that section of the South Kensington Museum; and in Professor Westwood's supplementary volume on the reproductions from ivories in other collections.

Of works in bronze, the more important are the doors of various churches in Italy and Germany. It will now, however, be necessary to follow the course of our subject in different countries through the succeeding ages; but before doing this we should direct attention to those bronze gates of Italian churches which were cast by order in Constantinople, and imported thence. Among these (the work of one caster, Staurachios, and the gifts of members of one family, the Pantaleone of Amalfi) are the doors of the Cathedral at Amalfi (A.D. 1066), of Monte Cassino (1066), of Monte Gargano (1076), and of S. Salvator, at Atrani (1087). Portrait heads and subjects in panels are represented on them by means of incised lines, filled in with silver and with coloured (metallic?) composition.

The small remains of the doors of the basilica of St. Paul outside the Roman walls, which were for the most part consumed in the great fire of 1824, and which were also figured with silver inlay, are of the same character and origin; they were made by Staurontius of Constantinople (doubtless another form of Staurachios), A.D. 1061-72. The bronze gates of St. Peter's, inscribed in silver inlay with the names of cities belonging to the Holy See, lost during the attack of Frederick I. in 1167, were restored to the old basilica in 1200, and were of similar origin. The bronze doors of St. Mark's at Venice are also of Greek workmanship; one of them is said to have been taken from Sta. Sophia at Constantinople, where some of the bronze doors, possibly the original, are still *in situ*. Of like workmanship, in style imitative of and derived from Byzantine handicraft, are the bronze gates of the duomo at Troja, of the earlier years of the twelfth century, about 1119-27, made by Oderisius of Beneventum, which have their figured decoration, consisting of portraits of bishops and others (the artist among them), in silver lines inlaid in panels: the lateral doors are similarly worked, but in niello.

Also figured in niello are the bronze gates of the Grave Chapel at Canosa, in Apulia, of remarkable design, partaking of the Byzantian character and the Saracenic, but the workmanship of an artist of Amalfi named Roger, who is said to have made a candelabrum, now lost. These were works of the earlier years of the same century.

We have seen that in Italy during the eleventh and twelfth centuries two influences were felt; the still lingering spirit of the antique, which took a form known to us as the Romanesque, and the imported eastern manner from Constantinople. In some districts also, as chiefly shown in Sicily, the Saracenic element might be observed. The Byzantine knowledge of processes and their artistic style were also spread by the returning crusaders, extending far and wide. We have referred to bronze gates executed by Greeks, or under the influence of their manner. We will now take note of similar works by Italian casters working independently.

Such are the doors of San Zeno at Verona, of wood, each valve covered with twenty-four panels, and every one a separate plate, beaten and not cast, separated and framed by mouldings, with lions' heads at the intersections; these, except two which bear the lion's head handles, are covered with *rilievos* of sacred historical subjects. They are fastened to the doors with bolts or nails, and the more recent were probably produced before the termination of the eleventh century; all are, however, very rude, particularly those of the left wing, some of which were perhaps the work of Guglielmo and Nicola da Figarola, in 1171. Those of St. Clemente, near Pescara, are also formed of plates of metal having subjects in relief and nailed to the wooden foundation. They are, however, of later date, in the following century. At Beneventum the portals of the abbey church, a noble work, are covered with subjects in relief, in seventy-two compartments. They are probably of the middle of the twelfth century, and of some technical excellence, in manner not quite free from Byzantine influence but more Romanesque, and inferior in style to those of Ravello. The doors of St. Ambrosio at Milan, enclosing panels of the earlier work, may probably be also of about 1170. Those of Trani and Ravello, dated A.D. 1179, and the smaller one of the northern side aisle at Monreale, are of the twelfth century, cast by Barisanus of Trani; they are remarkably fine works, having subjects in relief upon the panels, which are separated by arabesque mouldings of great richness, with rosette formed bosses at the intersections and lion's head handles. In these the artist frees himself from Byzantine influence, and throws great life into his figures.

At Pisa the architect Bonnano was also eminent as a bronze caster. He executed the gates for the duomo, of which the smaller pair remain at the southern transept, the larger having been lost in the fire. These show a great advance in respect to artistic modelling and composition beyond those of St. Zeno, but are somewhat of Byzantine character. The casting is also well executed. Full of subject, they represent incidents in the life of Christ, on sunken panels, the stiles being enriched with rose-like bosses, and surrounded by a massive cord moulding. They were made about A.D. 1180. Casts of them are in the South Kensington Museum (No. 65—58). He also cast the noble gates for the western portal of the cathedral at Monreale, a work full of composition and rich ornament, but also of marked Byzantine sentiment. In Rome, at the oratory of St. John in the Lateran baptistery, is a small pair of solid cast doors, with a few figures in relief, and designs of buildings, etc., in incised lines; they are by Uberto and Piero di Piacenza, in 1195.

(To be continued.)

Book Notice. — Messrs. Crosby Lockwood and Co., of Stationers' Hall Court, London, have made another valuable addition to their instructive series of trade manuals. It is entitled *Lathe Work:* a Practical Treatise on the Tools, Appliances and Processes employed in the Art of Turning. The author is Mr. Paul N. Hasluck. A review of this work will appear in our next.

CONSTRUCTION OF TIMEKEEPERS DELIVERED TO THE BOARD OF LONGITUDE, MARCH 7, 1805.

EARNSHAW'S ESCAPEMENT.*

(*Continued from page* 133.)

Q. What is the diameter and weight of the balance for a given main power, and likewise for a certain number of vibrations, viz., 18,000 in an hour, which is essential to determine, as it would serve as a general theory.

A The diameter of the balance without the weights and screws is one inch and one-eighth; with them, one inch and three-eighths. Weight of it, with compensation weights and screws, 3 dwts. 10 grs. Diameter of barrel which contains the main-spring, or first maintaining power, one inch and one-eighth and one-sixteenth; height of it, half an inch. The spring therein contained four and a-half or five turns, which is an unerring guide for anyone.

Q. What is the thickness of the steel rim of your balance, in thousandths of an inch? and what the size of the pivots of the balance axis, and of the pivots of the scape-wheel? and what is the weight of one of these screws?

A. The thickness of the steel rim of the balance is about eight thousandths of an inch, the size of the balance-pivots the same, as near as I can measure. The scape-wheel pivots should be the least matter larger than the balance pivots. The weight of one of the balance screws should be about five or six grains, a little more or less is not material.

Q. Do you blue your balances? and if you do so, do you make any alteration to them afterwards?

A. I do blue the balances, but make no alteration afterwards.

Q. As bending is condemned, what method do you use of restoring your balances to their circular figure after they have been cut open, as the circular figure is thereby lost, and the rims sometimes close, and at other times open?

A. I do not restore them to the figure they had before cut open, but blue them after cutting open, to preserve the natural figure they then take.

Q. What is the equivalent weight of one of the compensation weights?

A. About twenty grains; a little more or less is not material.

Q. What internal defects occasion a watch to measure time differently in different positions? What position should the pallet of the balance have when at rest? And what is the effect produced by placing it in different positions?

A. Large balance pivots; because when the timekeeper is in a horizontal position, the pivot then acts on its point, but in a vertical position they act on their sides, which is an increase of friction, the balance cannot then vibrate so far as when horizontal. Another cause of error in different positions is, when the watch is in the position that the balance is under the scape-wheel, its vibrations will be different to those when in the position which places the balance over it; and if the long and short vibrations are not performed in the same time, or nearly so, the watch must vary in the different positions, from that cause and other causes too absurd for me to write on, as they are well known to the trade. When the balance is at rest, the face of the pallet should stand exact to the point of the wheel-tooth. If you place the face of the pallet without the tooth of the wheel on the right hand side, then, when the wheel is unlocked, it will fall on the round of the pallet instead of the face of it, and cause a considerable rubbing; and if placed more within the tooth it will have too much drop.

Q. When the weight is wanted to adjust the watch in the positions of 3 and 9, by what means do you obtain that weight, in the manner your balance appears to be made? If you know anything more that is material concerning the making timekeepers go nearly the same in different positions, communicate it?

A. To adjust the watch in positions of 3 and 9, I fix to one of the compensation weights that is downwards, when in that position that it loses most, a small piece of brass not larger in diameter than a common pin-head, and nearly as thin as foolscap paper. I fix it in with a very small particle of beeswax, not larger than the common dot of an i; that is if the watch is gaining on mean time. But if the watch is losing, I then take out the balance, and, with a drill, drill out a small matter from that compensation weight that is uppermost when in the position that the watch loses most; this I have found to correct it, without so many screws and fans as I have seen in some timekeepers.

(*To be continued.*)

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* Earnshaw's own description from "Smith's Compendium of Practical Inventions." Liverpool, 1816.

THE MANUFACTURE OF JEWELLERY IN PFORZHEIM, GERMANY.

By H. BUSH, Hull.

PFORZHEIM, in the Grand Duchy of Baden, a celebrated place for the manufacture of fine metal wares, enjoys a high reputation for its extensive manufacture of jewellery. The introduction dates from 1767; in that year the watch manufacturers, François Autran, from Orange, Amédée Christin, from Paris, and Jean Viala, from Genève, associated themselves with the intention of starting a watch factory in Germany, and petitioned the Baden Government for the privilege of establishment in Pforzheim, undertaking to admit for the first five years twenty boys and five girls annually from the orphan asylum as apprentices and claiming an annual subvention of 500 florins and exemption from certain taxes. This proposal the Government readily accepted, and the factory started under favourable auspices, and received every encouragement. About 30 workmen were employed at the beginning, but the number was increased every month, and before the first year elapsed the promoters petitioned the Government again for permission to extend their operations to the manufacture of jewellery and fine steel ware, and an additional capital of 40,000 florins, which, after due consideration, was granted and advanced. This enabled them to bring material and able workmen from Switzerland to Pforzheim, and the number of hands employed reached up to 80 at the expiration of the first twelve months. An Englishman of great commercial energy, John Ador, joined the undertaking, and all prospered for some time; but differences between the managers in the various departments brought about a separation, which resulted in Autran and Ador carrying on the manufacture of jewellery, whilst Viala and Christin pursued the watchmaking. The manufacture of jewellery and steel ware prospered beyond expectation, but that of watches failed to maintain an existence, notwithstanding liberal and repeated grants by the Government, and had to be discontinued. In 1777 Autran retired, and the establishment was carried on by Ador, who turned out goods of superior quality, which found a ready market all over Europe, and the workmen enjoyed good wages, earning from 8 to 30 florins per week. The value of gold manufactured into jewellery at this establishment in the year 1800 amounted to 300,000 florins.

With the beginning of the present century the goods began to be exported to America, which greatly extended the business and encouraged the investment of capital. New establishments, with able workmen from all parts of Europe, sprang up rapidly, and the year 1850 counted no less than 206 establishments, employing nearly 7,000 men, besides a great number of boys and girls.

This industry kept on increasing up to 1873, when, owing to the commercial crisis in Europe, a falling off took place with a reduction in the number of workmen employed. Many of the workmen now began business on their own account in a small way, and this resulted in dividing the work into many branches and specialities.

The jewellery manufactured at Pforzheim is of great diversity; the fashions of all countries are studied and gratified, and a brisk export trade is carried on. Pforzheim is also celebrated for superior tools and machinery in the manufacture of jewellery, and for chemicals and materials employed therein.

INDUSTRIAL TRAINING.

BY AN OLD TECHNOLOGIST.*

(*Concluded from page* 138.)

THERE is yet a further count in the indictment. The spirit of apprenticeship, in modern times, is one of inveterate opposition to improvement. The inventor, if he can gain a fair hearing from the capitalist, is at once scouted by the British workman by the plea that, never having "served his time," he is a mere ignorant outsider, and that anything he proposes may, or rather should be, set aside without further scrutiny. It is a great mistake to imagine that "red tape" is confined to governmental or municipal bodies. There is not often found a manufactory without its small "circumlocution" department; and if the proprietor does not indulge in this feature, his men rarely fail to make up for the deficiency.

Lastly, but not least, apprenticeship is the true reason why the sons of the poorer middle-class families prefer the semi-starvation of a clerkship to the higher emoluments of the artisan. It is quite a mistake to imagine, as is done by some hasty observers, that this preference is due to any abstract contempt for manual labour or love for "gentility." There is a more tangible hindrance. There is the burden of the premium to be paid down at once, often before it can be ascertained whether the master is really a person to whom the guidance and control of a youth can fitly be entrusted. Above all, there is the state of serfdom, not merely in relation to the master, but to every rough about the place who is "out of his time." What this serfdom means to a youth who has been brought up with habits of decency and ideas of self-respect, it would take an abler writer than I am to picture. Suffice it to say that to the average "British workman"—(I fear it might be said to the English mind altogether)—there is no being so incomprehensible and ridiculous as a poor gentleman. The Spaniard, the Frenchman, the German, I may add the Scot and the Irishman, can appreciate refinement, courtesy, highmindedness in any position. We are unable to do so, unless to these attributes is added the power to fling shillings to every man who says, "It is a dry day." Then, indeed, we touch our caps and say, "That's a real gentleman!" Does the reader now understand why the sons, e.g., of struggling professional men, of "younger sons of younger brothers," and of all whose culture is higher than their means, are compelled to hold aloof from the trades, and must remain so until the guardian imp "apprenticeship" is exorcised?

It may, however, be asked, if apprenticeship is so decidedly hurtful, how does it happen that its formal abolition has not long ago been effected? I answer that the case is very similar to that of our defective patent-law system. The evils are manifold and serious, but they do not lie on the surface. The whole affair, moreover, is one of a plain practical character, giving little scope for sensational eloquence, and not fitting into the programme of either of the great political parties. Moreover, the apprenticeship system, with all its failings thick upon it, plays into the hands of two classes, who will most strenuously oppose its reform, or rather its abolition. There are a certain class of employers, both in the productive and in the distributive groups of businesses, who subsist to a great extent upon apprenticeship premiums. Having little real business, little experience, and often little skill, they have not the opportunity to "well and truly teach the craft of"——— to the unfortunate youths whose parents are gulled by their advertisements. In such cases the affair is an empty form, and nothing more. The victim, when his term is out, or rather long before, makes the discovery that his time and money have been spent for nothing. Lawyers will of course remind me that there is a "remedy" for all this, and that damages may be recovered from a master who has not duly instructed his apprentice. This is perfectly true; but what damages can bring back five or seven years wasted at the most critical part of a young man's life? "Premiums" simply enable dishonorable tradesmen not merely to get their work done for nothing, but to be paid for letting some one do it! When the indentures are expired the injured youth is quietly dismissed, and a fresh gudgeon is ensnared in his place. Is it likely that the class who profit so largely by this iniquitous system will be anxious for its reform?

Perhaps a still more obstinate resistance may be expected from the workmen. As a rule, where apprenticeship is most general, trades'-unionism and its interference between capitalist and workmen is most rampant. Throw open a trade to the world, and it will be no longer possible to maintain that law which decrees that the bad workman or the idler shall be as highly paid as the clever and the industrious, and which compels the able to lower themselves to the standard of the most incompetent. It has even been said that to abolish apprenticeship would be to draw the poison-fangs of the unions, thus annulling their power for evil.

It must not for a moment be supposed that I think that a practical training in any art or manufacture can be dispensed with. On the contrary, I would demand in this respect increased thoroughness, and a final practical (not verbal) test, without which no person should be competent to exercise the calling in question. But it should be open to any person, no matter how and where he had acquired his knowledge, to come forward and offer himself as a candidate for the test. All "binding" for any term I would absolutely prohibit. Every member of a trade who had himself passed the test should, on giving proof that he possessed the needful facilities, be licensed to receive pupils for practical instruction. Such pupils should pay as is done in colleges, i.e., not a "premium" or lump sum down, but a quarterly or yearly fee, and should be at liberty to go to another instructor or to another business if either were found, on further acquaintance, to be unsuitable.

Whether this practical training in the workshops should precede or follow a study of the principles of the art or manufacture in one of those colleges which it is hoped will spring up in all our large towns, I would not venture to decide.

SPECIAL NOTICE.

WE have much pleasure in informing our subscribers that this Journal will undergo further improvements with our *seventh year, commencing with July number*. It will be permanently illustrated with first-class designs for jewellers, silversmiths, etc.

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* In the *Journal of Science*.

THE DISCRIMINATION AND ARTISTIC USE OF PRECIOUS STONES.*

By Professor A. H. Church, F.C.S.

It was not without set purpose that I associated a scientific and an artistic conception in the title of this paper, for I am desirous of making a contribution, though it be but a small one, to the intelligent study and intelligent employment of precious stones. And I am convinced that some acquaintance with the less obvious qualities of well known gem-stones, and with the distinguishing characteristics of those species which remain practically unrecognised and unappreciated, will help forward the improvement of the jeweller's art in this country. Most admirable and pleasant colour-combinations are attainable by the aid of materials which, in many cases, are now by no means costly. Curious and delicate hues, of luminous quality, and in enduring substance, may be arranged and grouped in forms of endless beauty and variety. Neither silks nor paints, nor even enamels, can ever equal the colours of precious stones in durability, or in brilliancy and pulsating variety of hue. By pointing out some of the methods of discriminating one stone from another, I hope to be able to explain the modes which I shall cite or suggest, for their artistic employment. But I hope to do more than this. For when we know something about the intimate nature of any art-material, we begin to feel a more intelligent and a more lively interest in examples of good workmanship wrought in the substance in question. Every *connoisseur* or collector of artistic objects must have shared in experiences of this kind. He may have been once quite dead to the peculiar merits of certain works—say, in bronze, not even glancing at any specimens falling in his way. Then some casual circumstance, perhaps an exciting contest for a fine piece of work at a sale between two enthusiastic collectors, or perhaps the gift of a choice specimen, may have drawn attention, I will not say to the merits of such specimens, but at least to the esteem in which they may be held. Curiosity—it may be an intelligent curiosity—is excited. Investigation, more or less searching, follows. The hardness of the metal, its *provenance*, its designer, its age, the mode of manufacture, whether by casting or hammering; the manner of decoration, whether by chasing, engraving, or inlaying; the colour and texture of the surface, the presence or absence of *patina*, and not a few other points of interest, constitute the materials of complex study. Study provokes observation, and observation study, so that before long the neglected group of artistic bronzes exerts a kind of fascination upon the new votary. If his knowledge be superficial and inaccurate, or if he be merely an amateur or collector just because it is a fashionable pursuit to gather together or to admire certain classes of artistic objects, well, then, he does not really know what and why he admires. Forgeries delight him just as much as genuine works, so long as he is not sure that they are forgeries; but he has not sufficient patience for the mastery of, or sufficient insight into, the characteristics of true productions, to discriminate them from those that are false. It often happens thus with the amateur of precious stones. He knows nothing of the optical elements, say, of surface lustre, and the pleochroism which go to make up the *tout ensemble* of any particular gem, and is quite satisfied with a well-cut bit of paste, or a cleverly contrived doublet. No doubt, in some cases, even an educated keenness of vision does not suffice to distinguish the true stone from the false, although the durability of the genuine specimens will ultimately prove their superiority. But it is not difficult to learn to appreciate the peculiar and essential characters of the majority of the species of precious stones. What I wish to compass to-night, has then, not merely relation to the artistic use and arrangement of gems, but also to the appreciation of their inherent characteristics, so far at least as these affect their appearance. I want to sketch these characteristics, and then to compose them into pictures. For this purpose I have set down, in some sort of order, the most valuable optical distinctions belonging to precious stones, arranging these under the general heads of "Surface" and "Substance":—

1. Plane	Form ..	Surface ..
2. Curved		
3. Metallic	Lustre ..	
4. Adamantine		
5. Resinous		
6. Vitreous		
7. Waxy		
8. Pearly		
9. Silky		
10. Transparent	Light ..	Substance.
11. Translucent		
12. Opalescent		
13. Chatoyant		
14. Opaque		
15. Prismatic	Colour ..	
16. Monochroic		
17. Pleochroic		
18. Fluorescent		

I will now proceed to give some examples of the use of such a tabular statement as this. Referring to the shape of stones, we note that their boundaries are either plane or curved. Now, if we want to use curved surfaces, like those of pearls, we shall find that it will not answer to associate with them other curved surfaces, like those of the *en cabochon* moonstone; and especially is this the case where the size of the stone as well as the character of the curved surface is nearly identical; but a happier result will be attained by combining a step-cut stone with one having a curved surface. Once more, citing an example from the series of adjectives expressing qualities of surface, it will be found that gems having an adamantine lustre assort better with those which present the less brilliant surface known as waxy, than they do with those which show a nearer approach to the adamantine surface, and which are called resinous. The diamond and the jargoon do not improve or bring out each other's qualities, for they have too many points in common; but the diamond accords well with the pearl, and the jargoon with the turquoise, that is, the adamantine with the pearly, and the resinous with the waxy. Looking, now, into the substance of stones, rather than on their surface, their relations to the transmission of colourless light furnish many illustrations of wise and unwise, or effective and defective combinations. For example, chatoyant stones, like cat's-eyes, do not associate well with translucent stones like the chrysoprase and the chalcedony—the translucency of the latter confuses, because it resembles too closely the chatoyancy of the former. But transparent stones accord well with all those which interrupt the passage of light by such internal reflections. The diamond, on this account, combines admirably with the cat's-eye and the pearl, but it affords too strong a contrast, especially when of large size, with the turquoise, to associate pleasantly with this nearly opaque stone. From amongst the qualities pertaining to the colour of stones, examples of the utility of my table may be cited. When a stone has much "fire" in it—that is, when its refractive and dispersive actions upon light are high—and it shows prismatic hues, then it looks best if associated with gems in which this property is less developed. Again, monochroic stones, which in all directions transmit beams of the same colour, should be associated with pleochroic stones which exhibit two or more hues, while the latter should not be mixed together.

(*To be continued.*)

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*A lecture delivered at the Society of Arts

THE
WATCHMAKER
JEWELLER.
AND
SILVERSMITH'S
TRADE
JOURNAL.
W H TILBY

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades

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CONTENTS.

	PAGE
The Application of Hand Work	155
Book Notice	156
Electro-Magnetic Clocks	156
Machine Work *versus* Hand Work (A Reply to James U. Poole)	157
The Construction of a Simple but Mechanically Perfect Watch	158
Supplementary List of Awards at the Melbourne International Exhibition	159
Taxation of Silver Plate	159
Curiosities of Clocks and Watches	160
Practical Instructions to Jewellers, Silversmiths and Electro-platers	161
Trade Notes	162
Soft Pinions, &c.	163
Lectures on Watch and Clock Making ..	164
The Discrimination and Artistic Use of Precious Stones	166
Construction of Timekeepers Delivered to the Board of Longitude, March 7, 1805..	168
On the Fluctuations in the Relative Values of Silver and Gold, with Special Regard to the Present Depreciation of Silver in India	168
A London Hotel Home	i
Bills of Sale	iv
Patents	v
Monthly Record of Bankruptcies	vi
Directory	viii
Advertisements	iii—xvi

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THE APPLICATION OF HAND WORK.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir.—It has occurred to me after re-perusing my last paper that an intelligent foreigner might take exception to certain work being done twice over; but I contend that these constant re-examinations have sustained the high character of English work, a character which I believe will be maintained, notwithstanding the vigorous attempts which are being made to undervalue it.

It may be said, Why not take a balance exactly proportioned and apply a spring of a certain size and strength, in the manner spoken of by M. Favre Perret, after the Centennial Exhibition in 1876, and secure compensation and adjustment at one stroke? But in this very exactness lies the elements of deterioration.

A best balance maker knows that his balance and screws will be tested by a skilful adjuster, and is therefore necessarily compelled to be more particular than if the spring were put on exactly to time and the screws not shifted afterwards.

The springer is sometimes hampered from vexatious causes arising from the divergence of ideas which prevail among finishers as to the sizes of springs; but this partly arises from the fact that it is not the custom for best finishers to spring their watches, consequently they lose the advantage of seeing the spring actually in operation. This applies principally to flat springs. Breguet springs are not so much affected by these causes, as the outer circle is not confined by the stud or curb pins.

The latter are now almost invariably used for best watches. It is a curious fact that only a very few English workmen are able to manipulate them, and their presence on cheap watches is *primâ facie* evidence of their foreign origin. The Swiss apply "imitation" Breguet springs [I use the word advisedly] as readily as they do flat ones, and by so doing they avoid the nuisance of two coils getting into the curb pins, to which flat springs are so liable if the watch is jerked.

As regards performance, a properly timed watch with flat spring will hold its own against any other, especially if the spring is made to recoil slightly on the curb pin, but this arrangement is likely to be disturbed by the first stranger who handles it.

This, however, applies equally to Breguet springs; the great majority have indexes, which is undoubtedly a barbarism, because the springer is compelled to accommodate the shape of the overcoil to the circle of the curb pins, and if it is left to act freely between them so as to be under the control of the regulator, the watch is certain to go very slow in positions, and the only way to "fetch it up" is by placing the spring against the curb pin, which has the effect of making the regulator useless; it just remains as a show piece and all adjustments for mean time must be made by the screws. Nevertheless, the public like to think that they have the power of regulating their watches, and so indexes have to be retained; and they certainly make the interior of the watch look more effective.

For scientific correctness, however, the free Breguet spring is unsurpassed, the overcoil being subjected to no hampering conditions, may be manipulated with great nicety, and when once correct is not likely to be interfered with, if handled with ordinary care.

I should have said before that the action of a Breguet spring, either with or without index, is much more equal than that of a flat one which is fixed on one side to the stud.

The cylindrical spring, uniformly used for marine and pocket chronometers is seldom used for levers: in performance for pocket watches, it offers no advantages over the Breguet, and as it requires so much room the escapement is cramped in consequence. The mention of the chronometer spring naturally leads the way to the subject of isochronism.

This difficult word simply applies to that inherent property which a spring possesses of causing unequal vibrations of the balance to be performed in the same time. In a marine chronometer these are supposed to be exactly equal, and the spring is adjusted accordingly. A tall spring of say twelve turns would be so pinned in that the front of the stud is directly over the collett, whereas a shorter one would have the stud considerably in advance of it. This is in opposition to the manner in which I referred to the mode in which a spring should be pinned in to a pocket watch, which is not timed by correct isochronism but by an *adaptation* of the isochronal properties of a spring. Pocket springs gain in the short vibrations in order to overcome the extra friction caused by the balance and escapement pivots acting on their sides, while the watch is worn in the pocket. A marine chronometer, on the contrary, is always in one position, and the adjuster can concentrate his attention on the isochronism and compensation. It is usual to test the former by letting down the main spring so as to cause the vibration to fall off half or three-quarters of a turn, but many springers proceed by the rule of thumb; they know that a spring of a certain length usually requires certain treatment, and act accordingly.

When a chronometer or watch, the spring to which has been applied according to the most approved rules, performs irregularly, mechanical errors must be looked for, and this sentence introduces the next topic which I said I should deal with, viz., the examination of a pocket chronometer escapement, which is a profound mystery to many. I would here say that, with a sincere desire of enlightenment on any point appertaining to this topic, I have inspected the chronograph spring on view at the office of this journal, and which is regarded by Mr. Whittaker as a conclusive proof that a chronometer detent can be made by machinery.

I am not writing with the slighest expectation of altering that gentleman's opinion, but at the same time I have an equal right to my own, and beg to assure your readers that the statement is entirely incorrect.

The spring in question is used for one purpose only, viz., for steadying the wheel which carries the chronograph hand by means of a slight downward pressure. It is stamped out of a very thin piece of steel, and is too thin to polish or manipulate in any way after being left by the machine. In fact it is just what a machine might be expected to do; and if I were writing with the idea of achieving a victory over Mr. Whittaker, I should consider that I had fairly turned his flank, but I am content to be judged by the numerous readers of this journal, and will ask them to accept the statements of one who, without egotism, may claim to have received a thorough practical education as a workman.

The new war cry of "watchmaking by machinery" is a mere puff as applied to best watches. The Swiss have produced marvellous mechanical contrivances for a century, using machinery wherever suitable, and supplementing its action by skilled hand work.

I have deviated so far from the chronometer escapement which I was about to examine on paper, that it must remain in *statu quo* until next month, when I will prove to the satisfaction of an overwhelming majority of your readers that it cannot be made by machinery.

I am etc.,
33, Spencer Street, Clerkenwell. James U. Poole.

BOOK NOTICE.

Lathe Work. A Practical Treatise, by Paul N. Hasluck. London: Crosby, Lockwood, & Co., Stationers' Hall Court.

Tools and their use, is the bridge that connects science and practice; but "how to make" them and "how to use them," constitute again a method of action, and a science which are the architects and builders of this structure, that unites these productive generators of social and universal appliances. The Lathe stands formost, as a tool, for usefulness and for amateur fascination, and admits of endless modes of applications. In the light of this fact, it is a marvel that so little has been written on this subject, and hence the production of Mr. Hasluck supplies a great want. It forms a descriptive treatise of the most general forms of the modern Lathe, inclusive of the "modern Lathe" in our great-grandfathers' days, also of the various forms of appendages, such as chucks, slide-rest tools, overhead gearing for wheel-cutting, &c., as well as of their use and production. It is very well got up, and the illustrations are very creditable. Its popular form is suitable to the standard of the general reader, and will form a basis and an incentive to more scientific production. The subject is of special interest to watch and clock makers. The Lathe admits of far more extensive application in watch and clock making, than many workmen are aware of. Work produced with turns and bow, reaches often a very high standard, but it is a slow process, and requires much and continual practice, and is no way as a "duplicatory process." Slide-rest turning does not require near the practice, and is certainly superior for uniformity and truth, and even delicacy, as it must be, because in hand-turning the direction of the pressure exerted by the tool is at right angle to the axis, whereas in slide-rest turning it is parallel to it. The American watchmaker evidently recognises its great service, and hence extensively uses it. That the "bow" should still reign supreme in many shops of escapement makers, finishers, &c., is remarkable. We commend "Lathe Work" to watch and clock makers who are interested in the practical part of their trade. It will supply them with much useful information in a plain form, suggest new ideas in relation to their daily work, and bring within their reach methods for obtaining results by quicker and easier methods than others now in use. I. Herrmann.

ELECTRO-MAGNETIC CLOCKS.

A MANUFACTORY of electro-magnetic clocks, on the "Schweizer system," is now in full swing at Soleure (Switzerland). They are said to go for two years with great punctuality, and without any further attention. The price of these clocks is about £5.

MACHINE WORK *versus* HAND WORK.

A Reply to Mr. James U. Poole.

No. VI.

(*Continued from page* 142.)

We have now brought before our consideration a course of instruction (see page 41, October number of this Journal) which is designed to impart to young beginners that amount of skilled labour which is required to supplement the productions of machinery. This is a limited view of hand work, and before I deal with these matters I will endeavour to show the relation that exists between machine work and hand work.

At the very outset I am bold to assert, there is an essential unity between the two systems. They are not at variance with each other, each has its proper place which gives mutual help, in fact they are in partnership which cannot easily be dissolved. To pass a sweeping condemnation on everything that is hand-made, is the folly of those who suffer from machinery on the brain, and is equalled only by those who in a similar way condemn machine work.

The history of machine tools in other industries supplies many illustrations of the good relation that exists between machine work and hand work, *e. g.*, the printing machine did not destroy the use of the quill pen, on the contrary it increased it, until the demand for quills exceeded the supply, which gave rise to a great industry—the steel pen trade, which is now threatened by a stylographic invasion. Am I not at this moment with my pen, hand work, doing that which the printing machine cannot do, and though the pen is a small hand tool, it is really the powerful lever that sets the ponderous printing press in motion.

The art of photography, a machine system, has not yet closed the doors of the Royal Academy, and the prospects of its ever doing so are exceedingly small. And there are those living to-day who can recollect how that fifty years ago, certain false prophets declared that George Stephenson's steam locomotive would do away with vehicular traffic, and therefore destroy horse property, and though the goods and passenger traffic on railways has far exceeded the most sanguine expectations of the first railway promoters, yet vehicular traffic and horse property have advanced in like proportion.

Numberless instances of this kind might be adduced to show how machine work fosters hand work, though it must be admitted that in the transition from one system to another some interests are likely to suffer, and the greater the opposition that is offered by hand workers to machine tools in watch making, the greater will be their suffering, for when the wave of improvement rolls in, all the old Mrs. Partingtons in the world cannot stop it.

Speaking upon this subject the other day to an American merchant, he told me that quite recently the trade in sewing straw plait for bonnets and hats in the United States had been changed from hand to machine work, and yet there could not be found one instance of opposition offered by hand work, and though this industry numbers many thousands, no case of suffering could be found, all were alike benefited by the improved system of working, which greatly increased the trade; would that I could say the same of the thousands that are employed in the watchmaking trade in this country. The *liberality* that Americans universally show to improvements is one of the things we want to import into England. Why do the champions of free trade levy a prohibitive tax on *improvements?*

Let us without partiality enquire wherein the machine tool succeeds, and wherein it fails.

The trade in certain kinds of watches at the present time is sufficiently large to use machine tools with advantage, yet there must be the most rigid economy in their extent, and they should be so made that more or less of the advantage of machine work be extended to those watches which on account of the smallness of their numbers cannot with economy be entirely made by machinery. Let me explain the matter; suppose a factory turning out 5,000 going barrel watches per week, to include a full line of ladies' and gentlemen's key and keyless three-quarter and half-plate watches. I will assume that a 14 size (19 lines) open face, and 12 and 14 size hunters are the best selling sizes for gentlemen, of which 3,000 per week are required, and the remaining 2,000 to include a good assortment of 2 and 4 size ladies'. How can we arrange the machine tools with a view to economy. I will endeavour to give a few suggestions, confining my remarks to the centre wheel-blanks, though what I say of the centre wheel is to a great extent true of every other part of the watch. I will assume that it has six arms, and the diameter of the 14 size centre wheel be $\frac{57}{100}$ of an inch, of which only 3,000 will be required per week for going barrel watches, (the diameters of the train and keyless work in 12 sizes, half-plate hunters are the same as 14 size three-quarter plate) but 300 more will be required for best adjusted fusee watches, and 100 will be wanting for the third wheels of 24 size watches, also 100 for the fourth wheels of two day marine chronometers, also 5,000 for the third wheels of the going trains of a small striking clock, also 5,000 for the third wheels of the striking part of the same, also 5,000 for third wheels in small portable timepieces, also 5,000 for the scape wheels in larger clocks, also 100 for centre wheels of chronographs, also 500 for third wheels of carriage clocks, making a total of 30,000 blanks. In like manner the third wheel blanks of 14 size work will make centre wheels of 2 size work. So the reader will see that by careful management there may be great economy in machinery, and it is not too much to suppose that as in times past many kindred industries, such as mathematical, nautical, astronomical, meteorological, and optical instrument making, have been greatly benefited by the skilled hand labour of watchmakers, so these industries, together with electricity and small engineering, might derive benefit from the machine tools of a watch factory, for many parts of the work are identical and may be as universally used as a Whitworth screw.

The machine tool succeeds only in cheapening the production of *large quantities* of duplicated work that are uniform in size and style. Machine tools offer no advantage in making very small quantities of work. In addition to the alleged incompleteness to which frequent reference has been made, the system is essentially limited in *variety* of production, and though it is not so inflexible in this respect as some suppose, it is admitted that in this relation to art work the machine tool competes unfavourably with hand work, there is a stereotyped sameness that is perfectly wearisome, that soon palls upon the taste, and becomes a drug in the market, and from which there is no way of escape save by skilled hand work, which not only supplements, but takes the initiative, remodels as fashion may dictate, and so sets and keeps the machine tool going. In connection with this subject, it must be remembered that the entire watch trade, for which there is so much eager contest, is a small business, compared with the transactions in coals, iron, cotton, railways, etc.; the figures are remarkably small. It is estimated that only about two and a quarter millions of watches per annum are required for the trade of the whole world, which includes an almost endless variety of styles, some of which have to be partially made by hand; consider also that there are few things in which public taste is more capricious than in the watches we wear. There is always a desire for change, and those who worship fashion will find funds to gratify this desire.

The reader will see there is yet room for hand work, and the cause of our slackness in the English watch trade is not that skilled hand labour is entirely superseded, but because we have in the midst of so much light and progress strangely allowed our system of manufacture to lapse into a most imperfect condition, and that we are determined to pursue this unwise policy in spite of experience. Without blushing or the slightest hesitation we have told the world that we have not got a straight edge or a surface plate, that we are without even a recognised gauge, or a template worthy of the name; evidence for this statement will be found in Mr. Poole's letters, and yet we are constantly asserting that *English watch manufacturers justly pride themselves on producing the best watches that can be made*, and all this is dinned into the ears of men who are careful to note what we say, and are not wanting in prudence to look at our work, nor slow to ask "Can a corrupt tree bring forth good fruit?"

Richard Whittaker.

THE CONSTRUCTION OF A SIMPLE BUT MECHANICALLY PERFECT WATCH.*

BY M. GROSSMANN, Watch Manufacturer,
Glashuette (Saxony).

(*Continued from page* 143.)

93. I often see Swiss watches of recent make having the heads of the casing key-screws below the dial. This arrangement has no comprehensible advantage, but subjects the repairer to the vexation of being obliged to take hands and dial off before he can remove the movement from its case.

94. The setting square ought to be provided with a cap, as well as the winding square, in order to prevent any particles adhering to the key from entering into the movement. Care must be taken to have these caps reach up to the inner side of the dome, and without any excess, because this would, especially in a strong case, produce a pressure on the plate when the case is shut, and which would often be sufficient to stop the watch by reduction of the necessary end shake of the pivots.

95. The cases in which the movement can be opened with a joint offer a greater convenience for the exact timing of the watch, because the timing screws of the balance are more accessible; but this convenience is of no great consequence.

96. It remains to say a word about the contrivances having for their object the protection of the movement, or of certain parts of it, from the dust penetrating through the case. The most perfect dust cap is that of the old English full-plate watch, because it covers the whole movement, without the slightest exception. In the majority of cases it is admirably made, and effects its purpose very well. It has been tried with similar success to protect the movement of $\frac{3}{4}$-plate watches, though the dust cap, by the additional height of case it requires, does not harmonise with the modern watch. It was an absolute necessity to employ it with the old cases opening and shutting with springs, and consequently far from being dust proof. But with the gradual progress of case-making, the cases shut tighter now than they used to do, and therefore the dust caps can be entirely dispensed with. The fittings of the cases, if they are made with a little care, shut very closely, and nevertheless open and shut with ease. For this purpose the rims must not be too much undercut. The best class of English cases are generally fitted with much care and judgment. The rim ought to be slightly rounded for the smooth passage of the shutting edge of the rim over its highest point. (See fig. 26.)

97. The dust covers in ring shape, surrounding the frame of full-plate movements, avoid the disadvantage of occupying more height in the case, but they are also so much less efficient. What is the use of protecting the train from dust, if at the same time the balance, the pendulum spring, and the counter sinks in the upper plate with the oil in them, are exposed?

CHAPTER IX.

THE JEWELLING.

98. The jewelling is an improvement in horology belonging to its newest period. It is evidently a great progress to introduce a material indestructible by friction, not susceptible to chemical influences, and capable of the highest polish for the bearings of the pivots, thereby insuring the stability of their action, the preservation of the oil, and the reduction of frictional resistance to a minimum.

99. Jewel holes ought to be well examined before using them, because, if the hole is not carefully polished, or if its edges are rugged, they are worse than metal holes, for they wear the pivot very quickly.

100. According to my opinion, a movement ought to be jewelled throughout. The price of a pair of jewel holes is not so high as to form an obstruction to their use, and especially the pallet holes ought not to be left without jewelling. The angular motion of the pallet is very trifling, it is true, but experience tells us that when grinding any substance the reciprocating motion answers best of all, and the wear of a pivot in its hole is nothing else but a very slight degree of grinding. Besides, the jewelling of the pallet holes might be thought useful by the diminution of friction, and this is very essential in the lever, the inertia and resistance of which has to be overcome at every beat of the escapement.

101. For similar reasons, the third and fourth wheel holes ought also to be jewelled if the quality and intended value of the watch will any way warrant the expense.

102. To have the escapement, that is, the wheel and pallet cap jewelled, or with end-stones, is more a matter of taste than of practical utility. In the case of the balance, with its quick vibration to the extent of about 400°, it is of the utmost importance to avoid the amount of additional friction which would result from the bearing of shoulders against the faces of the holes, and thus the end-stones of the balance cannot be dispensed with. It will be obvious at the first glance that the pallet and wheel work under vastly different circumstances. In a movement of the usual arrangement, the pallet makes an angular movement of 10 deg. to 15 deg. for every vibration of the balance, and the wheel accomplishes, if it has fifteen teeth, 12 deg. of its rotation in the same period. Besides, their weight cannot be supposed to press so much in the vertical direction, because they are working under a continual and considerable side pressure. But the greatest difference between the position of balance pivots and that of wheel and pallet is, that these latter parts may be made as light as possible, while the balance is, and must be, considerably heavier.

103. The difference between the friction of a plain jewelled pivot and a cap jewelled one is extremely small, According to a generally established law in mechanics, that, the pressure being the same, the amount of friction is not altered by the extent of the bearing surface, it would be *nil*. But in our case, and especially because lubrication is required, the adhesion must be considered. Anyhow, the resistance to the motion of the cap-jewelled pivot can only be easier as the ratio of the difference of the bearing surface; and this difference between the surface of the pivot end and that of a properly reduced shoulder is a trifling one. With an angular motion of more than thirty times the extent of that of the wheel and pallet, it acquires, of course, a greater importance, and therefore the end-stones are indispensable to the balance. I freely admit that there is a little economy of power in the cap-jewelled escapement, but I wish only to point out that this very trifling advantage is generally overrated. The fact that a number of the best English watches are without end-stones to the escapement, seems to indicate that the English horologists look at this matter about in the way above mentioned.

104. The employment of a diamond as an end-stone to the upper balance pivot is a very good practice, because the watch, in its horizontal position, performs with almost all the friction on this pivot end, and the extreme hardness and fine polish of the diamond face will reduce the wear and friction to their smallest amount. It only requires some care to select the diamonds, because among those which can be bought in the material shops there are sometimes pieces defective in the point of polish, and in this case, instead of conserving the pivot, they might prove the means of its

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destruction. In this particularly I had a remarkable case in my own practice, which made me abstain from the use of diamond end-stones, if not expressly asked for.

I had to furnish a pocket chronometer which gave entire satisfaction to its owner. After six or eight months I was informed that the performance became irregular, and a noise was to be perceived in certain positions of the watch. I got it sent back, and on examination I found the upper balance-hole worn out to an elliptical shape, so much, indeed, that its diameters were about as 2 to 3. With the aid of a microscope I found a very slight defect in the surface of the diamond cap, and replaced it by another one. The hole, of course, was also replaced, and the pivot, which had not suffered in a perceptible way, was a little repolished. The watch, after this, performed as before, but after another service of about six months I had it back with the same complaint. On examining it, I found the upper balance hole in quite the same state. This, according to my opinion, could only be attributed to a microscopic particle of diamond having penetrated into the pivot, where it had been retained, notwithstanding the repolishing, perhaps even by this very operation. After the replacement of the jewel hole and balance staff, the watch has performed many years without any derangement.

This shows how carefully diamonds must be selected, and an eye-glass of the greatest power will not be sufficient for this purpose. The difference of friction between a good corundum end-stone and a good diamond is at any rate very trifling, therefore I do not think it advisable to expose a watch to dangers like the above-mentioned for so slight a gain.

105. The good and careful execution of the balance holes forms the most important point in the jewelling of a watch. Not only must they show, like all the other jewel holes, an irreproachable polish, but they must be rounded in a proper manner in order to make the resistance in the vertical and horizontal positions equal, or as nearly so as it can be done.

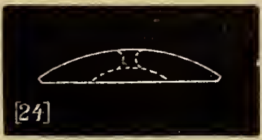


Fig. 27.

106. It may be considered a good plan to make the balance holes on the conical method, in order to give them a greater strength, and to facilitate the entrance of the pivot when putting the balance-cock on; but they require great care in their shape, lest the adhesion might be increased. Besides, a cock with its steady pins, made in the way previously described (83), renders it very easy to put the cock on without injuring the jewel hole.

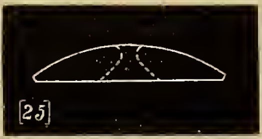


Fig. 28.

107. The setting of the jewels is a matter of very different execution. In some, especially the better class of English watches, the jewels are set in brass or gold settings, which latter are fitted into holes with countersinks, and fastened with screws, the heads of which partly intersect the circumference of the setting, while the thread is tapped into the plate and the head of the screw sunk into it, so as to be level with its surface.

(*To be continued.*)

SUPPLEMENTARY LIST OF AWARDS AT THE MELBOURNE INTERNATIONAL EXHIBITION.

For First Class Award.

Boardman & Glossop, Sheffield, goldsmiths' and silversmiths' work.
James Dixon & Sons, ditto ditto ditto.
Lee & Wigfull, ditto ditto ditto.
Roberts & Belk, ditto ditto ditto.
Woodward & Co. ditto ditto ditto.
Grimshaw & Baxter, London, watch tools.
Hobbs, Hart & Co., London, fire and burglar proof safes.
Milner's Safe Company (Limited), Liverpool, ditto ditto.
Kilpatrick & Co., London, silver ware and jewellery.

For Second Class Award.

Harrison & Co., Sheffield, goldsmiths' and silversmiths' work.
Chubb & Sons, London, fire and burglar proof safes.
Sicker Safe and Strong Room Company, Birmingham, ditto ditto.

For Third Class Award.

J. & R. Glen, Edinburgh, goldsmiths' and silversmiths' work.
W. Hick, Huddersfield, solitaires.

For Fourth Class Award.

S. Cranmore, Birmingham, imitation jewellery
Sextus Brothers, ditto ditto.
Phillips & Sons, ditto fire and burglar proof safes.

TAXATION OF SILVER PLATE.

From letters received we gather that some of our readers are under the impression that the plate question has been quite settled by the abandonment of Mr. Gladstone's impracticable scheme for the *gradual* abolition of the duty. Such is, however, not the case; the repeal of the tax is only temporarily postponed. The Chancellor of the Exchequer stated that he would have preferred total abolition, but could not see his way to the allowance of drawback. The fact is, his time is more than occupied with questions of deeper importance to the nation at large, and he could not give the matter the necessary attention. By the steps he took and the statements he made, he has, however, fully recognised that the tax is wrong, and that it ought to be abolished; and under these circumstances the question will naturally be kept before him until a satisfactory settlement is effected. While waiting, the trade will, unfortunately, go from bad to worse, as a revival in such a state of uncertainty is quite impossible. Shopkeepers will not stock, and as a consequence manufacturers will be obliged to limit their operations, and work will be scarce.

An improved watch-case spring has been patented by Mr. Jos. Canne, of Newport, Ky. The object of this invention is to provide a more durable watch-case spring, the spring part of which can be replaced when broken, without renewing the body. This invention consists in forming the spring of sheet steel, having the thinner part toward the head instead of toward or near the body, as in other watch-case springs, so as to have the head on the most elastic part of the spring; in lapping over the head instead of forging it; and in cutting away the lower edge of the spring portion for the purpose of increasing the elasticity of the spring and diminishing its stiffness. By using sheet steel for the spring, no forging is required, and the strength of the spring is not impaired. By having the thinnest or most elastic part near the head, the spring is not so liable to "stay back" after usage, as is commonly the case with springs of even thickness, and with those that are thickest near the head.

CURIOSITIES OF CLOCKS AND WATCHES.

About 1796 some missionaries took out to Tongataboo, one of the Friendly Islands in the South Sea, among other things, an assortment of cuckoo-clocks, which soon became to the natives objects of universal wonder, the general opinion being that a spirit spoke in them, and would detect the people if they stole anything from the ship or the missionaries. Toogahowe, one of the natives, stood in such awe of them, that he would not have one of them in his house. Moomooe, his father, however, regarded them differently; and when he found himself dangerously ill, he requested that some of the brethren would come and sing psalms for him, and bring a cuckoo-clock to assist in healing him. The high priest, knowing perhaps the mysteries of his own profession, was exceedingly delighted with these clocks, desired to have one, and as soon as he got it home took it to pieces to examine the inside. To put it together again was beyond his skill, and unluckily it was beyond the skill of the missionaries also. None of them had been instructed in this branch of mechanism, and the discovery of their ignorance excited the contempt of the natives,

About 1797, a man named Fulton invented a clockwork machine to blow ships out of the water in battle; the adoption of which deadly instrument by the Board of Admiralty was sufficiently ridiculed in the Opposition papers of the day.

Early in the present century, the tower of the metropolitan church of La Seu, at Zaragoza, was finished from designs made in 1683. The allegorical statues of Time and Vigilance support the dial of a clock in the second story of this tower; but considering how lazily life flows along in Spain, there seems to be a touch of satire in this public hint. The cathedral at Toledo has two old lateral gates, one of which is called the Relox, or the clock-house, and also the Lost Child. The clock itself is placed in a handsome and comparatively modern tower.

A writer in 1809 tells us that in the Mansion House at Palma, in the island of Majorca, was a clock called by some the Balearic, and by others the clock of the sun, and well worthy of observation. No one was able to say where it was made, or from whence it was brought. It marked and struck the different hours of the days and nights according to the progress of the sun, and the different solstices; and it was generally allowed to be the only one of its kind in the world.

In the *Gentleman's Magazine* for 1816, we read that at Hatherleigh, a small town in Devonshire, there existed a custom that every morning and evening soon after the church clock had struck five and nine, a bell from the small steeple announced by distinct strokes the number of the day of the month. This probably was originally intended for the information of the unlearned villagers.

In the same magazine for 1817, we are told that a clock on an entirely new system had then lately been made by John Thomas, a native of Caerleon, who resided at Newport, Monmouthshire, and was a working smith and farrier. This piece of mechanism continued going, after once winding up, for the space of 384 days. It had a pendant, vibrating seconds, and a dial plate, showing minutes and seconds. The plates and wheels were of brass, and the pinions of the best cast-steel. It was in action at the maker's house.

The *Mirror* for 1823 tells us that at the clock-gate of Berne, Switzerland, about half-way between the pavement and the pinnacle, is a large party of wooden bears dressed like soldiers of the olden time, in coat, armour, and gabardines; some bearing a halberd and others a matchlock, and accompanied by several other bears, who act in the capacity of trumpeters and kettle-drummers. Directly the clock begins to strike the hour this company marches out of a little tower attached to the dial-square, and after nodding their heads to the people, walk to their original quarters. Above them sits an old pantaloon, with spectacles across his nose, acting as dummy on the occasion; and not far from him is a clown, who, seated like an Indian juggler, obeys the summons of the hour by striking in return two bells, right and left, shaking his head meanwhile very whimsically. At the extreme top of the clock-tower under a kind of belfry stands a large figure in armour to strike the hour on a great bell. This exalted personage is frequently mistaken for a plumber mending the clock-works. Besides all this, immediately above the arch of the gate is stationed a cock of gay and golden plumage, as large as life, who claps his wings and crows almost as genuinely as the real bird; an effect which is produced by mechanism acting on some organ stops. The redoubtable name of this clock-tower is Zeitglockenthurm.

Longfellow, in his "Hyperion," tells us that in the belfry of the Kaufhaus in Coblentz, is a huge head with a brazen helmet and a beard; and whenever the clock strikes, at each stroke of the hammer this giant's head opens its great jaws and smites its teeth together, as if, like the brazen head of Friar Bacon, it would say, "Time was; Time is; Time is past." This figure is known through all the country round about as "The man in the Custom House;" and when a friend in the country meets a friend from Coblentz, instead of saying, "How are all the good people in Coblentz?" he says, "How is the man in the Custom House?" Thus the giant has a great part to play in the town.

In 1823 was invented by T. W. George, of St. George's-in-the-East, an apparatus, which by the sole agency of a clock, lit a candle at any desired time. It was constructed in the following manner:—A pistol-lock was let into a piece of wood, which was primed with a few grains of pulverised gunpowder; a match was next suspended over the priming, in a slope with the candle's snuff; it was then cocked, and a rod of peculiar construction attached to the trigger was drawn out a certain distance, and secured by a tooth. The apparatus was then ready. The alarum at the desired hour ran off, and woke the workman up to an early-rising business, and the alarum-weight in descending came upon the trigger-rod, which it let loose, and effected the desired end simultaneously.

The *Bibliothèque Universelle* (a Swiss Revue) records particulars of a man named J. D. Chevalley, a native of Switzerland, who had in 1825, at the age of 66, arrived at an astonishing degree of perfection in reckoning time by an internal movement. He was, in fact, a human timepiece, a living clock. In his youth he was accustomed to pay great attention to the ringing of bells and the vibrations of pendulums; and by degrees he acquired the power of counting a succession of intervals exactly equal to those which the vibrations or sounds produced. Being on board a steamboat on the Lake of Geneva on July 14th, 1823, he engaged to indicate to the crowd about him the lapse of a quarter of an hour, or as many minutes and seconds as any one chose to name, and this during a most diversified conversation with those standing by; and further, to indicate by his voice the moment when the hand passed over the quarter, minutes, or half-minutes, or any other subdivision previously stipulated, during the whole course of the experiment. This he did without mistake, notwithstanding the exertions of those around him to distract his attention, and clapped his hands at the conclusion of the fixed time. His own account of this gift was as follows:—"I have acquired by imitation, labour, and patience, a movement which neither thoughts, nor labour, nor anything can stop. It is similar to that of a pendulum, which at each motion of going and returning gives me the space of three seconds, so that twenty of them make a minute, and these I add to others continually."

PRACTICAL INSTRUCTIONS TO JEWELLERS, SILVERSMITHS AND ELECTRO-PLATERS.

By A. Roseleur.

(Specially translated and revised for this Journal.)

No. XXVI.

(*Continued from page* 144.)

Gilding Thin Wires.—Under thin wires we mean the gold, silver, or gilt or silvered copper wires used in the manufacture of epaulets, military trimmings, etc. Gilt silver is called fine, gilt copper half fine, and copper and brass alone, false. At the present time, nearly all wire-gilding is done by electricity; the balls and the batteries are the same as those already described, but for the success of the operation a certain disposition of the apparatus is required.

Upon a brick furnace, which may be heated either with solid fuel or gas, is a cast-iron enamelled kettle, about 3 feet long, 18 inches wide, and 4 to 7 inches deep, for holding the gold bath. If gas is used as fuel, the burner should be an elliptic ring with 25 or 30 jets attached to it; or the same kettle may be used as a cold bath if desired, the fire being optional. At one end of the apparatus, near the battery, are two wooden stands, supporting an iron rod which passes through a certain number of wooden spools carrying the wire to be gilt. These spools turn freely upon the rod, and the unwound wires, before dipping into the bath, are pressed against a copper or brass rod connected with the negative or zinc pole of the battery; thus the wires are connected with this pole. The wires dip into the bath to about two-thirds of its depth, and are kept stretched by small grooved pulleys of glass, porcelain, or ivory, rolling freely upon glass or ivory axes, which are kept near the bottom by supports screwed on the top edges of the kettle. At the bottom of the bath, and crossing the wires to be gilt, are two or more platinum wires, the vertical branches of which communicate with the positive or carbon pole. These platinum anodes must nowhere touch wires to be gilt, as these two kinds of wire represent the two poles of the battery in the bath. At the other end of the apparatus is another series of wooden reels, upon which the gilt wire is wound up. These reels are fixed to the square iron axis which traverses them, and which is turned by gearing, slowly enough to ensure a good gilding to the wire during its passage through the bath. After passing through the gilding bath, the wires are rinsed and dried by winding over two wooden rollers revolving freely upon their axis, and plunged by means of grooved rollers into the first trough, filled with a weak solution of cyanide of potassium, which cleans and brightens the gilding; they then pass into the second trough filled with water, which is constantly replaced, and removes the salts from the wires. The drying rollers, covered with several layers of calico, are moved by gear in opposite directions; the wires are thoroughly dried in a flat tube, kept at a dull red heat in the furnace. In a kettle of the size named, 20 wires may be gilt at the same time. Copper wires are generally previously silvered and passed once through a draw-plate to avoid the cleansing process before gilding. The more intense the battery, or the slower the wires pass through the bath, so will the deposit of gold be increased; and it will be well to weigh the bobbins before and after the operation, for which purpose the spools for winding-up and winding-out should be of the same weight. This gilding requires constant supervision, either for uniting the broken wires, the severed parts of which may touch the anodes and stop the operation; or for regulating the intensity of the battery, which, if too powerful, will produce a red gilding, or, if too weak, a green one. Baths of double cyanide of gold and potassium are employed, cold or slightly tepid; baths with phosphate and bisulphite of soda are used for hot electro gilding, but they are concentrated until the proportion of water is one-half of that indicated. As the platinum anodes do not make up for the metallic loss of the bath, it is frequently necessary to add new portions of metal and salts, in the manner already described. Pure gold wire is sometimes gilt in order to impart to it a more uniform and deeper shade. After being gilt, the wire is passed through the draw-plate or the rollers. By the draw-plate it is diminished by about one-fourth or one-half of a number to remove the dulness of the deposit, and bring up the lustre. When the gilt wire is flattened between the rollers, its surface is bright or dull, according to the state of the surface of the rollers. Silvering, or any other metallic electro-deposit upon thin wires, can be effected in a similar manner.

Gilding with a Dead Lustre.—This can be obtained by five different methods :—

1. By the slow deposit of a large proportion of gold. This gilding is very durable, but dull and earthy in appearance, and is too costly for industrial purposes.

2. By acids; giving a dead lustre to the metallic surface before gilding, and by the processes described in our articles treating on the cleansing operations. This method is employed for small articles, or, when gilding by dipping for bronze articles, or large embossed work.

3. With frosted silver, by depositing upon the object to be gilt a coat of frosted silver, and then gilding in a good bath. This method is expensive; the burnished parts are greenish, and the intermediary coat of silver is more easily blackened by sulphur fumes than gold.

4. By copper. By depositing a solution of sulphate of copper, decomposed by a battery, a coat of this metal, which possesses a pink, dead lustre, the whole is rapidly passed through the compound acids for a bright lustre and the mercurial solution, and then gilt in a good bath. When the dead lustre obtained in the bath is perfect, the compound acids may be dispensed with, and merely place the article in the mercurial solution before it is gilt. This mode is generally preferred, as the gilding is very handsome in lustre and colour. The burnished parts will be red, if vinegar or soap water is used; and of a fine yellow colour if the burnishing tool be wetted with a decoction of flax-seed, or of marshmallow root. If the gold deposit is of insufficient thickness, it will blacken in time by the oxidisation of the intermediate coat of copper.

5. Dead lustre by mercury, or the old process of gilding by fire, which furnishes the most durable gilding, but also the most expensive.

Gilding by Fire or Mercury.—Mercury gilding will furnish gold with a bright or a dead lustre, scratch-brushed, ormolued, and with different shades. The amalgam of gold is prepared in the manner described in the process of gilding, by stirring; only a little less mercury is used, in order to have an amalgam about as hard as wax. This amalgam is crystalline, and a certain crackling sound is heard when the crystals are crushed between the fingers. A stock of amalgam is generally prepared in advance, and is divided into small balls of nearly equal size, the value of which is ascertained from their number and from the total weight of gold employed. These balls are kept in water, but should not remain too long without being used, as the different parts do not then present the same composition. The amalgam is spread with the finger upon a flat, hard stone, called the "gilding stone," and having dipped a scratch-brush of stout brass wire into a solution of nitrate of bin-oxide of mercury until it becomes white, it is passed over the amalgam, a portion of which is carried away.

(*To be continued.*)

TRADE NOTES.

The silver medal of the Worshipful Company of Turners is offered to the producer of the best set of three designs for clock cases. Competitors may submit either drawings or finished cases. All drawings or cases intended for competition to be left at the Horological Institute, Northampton-square, not later than Saturday, September 24. This is a step in the right direction, and it is only to be regretted that design in clock cases has not been encouraged before. It is owing to our want of taste in this branch that the importation of French clocks has assumed such proportions, with what effects on the English clock trade we know only too well.

Switzerland, and Geneva in particular, has long enjoyed a unique reputation for painting on enamel, and we advise those of our readers who take an interest in this beautiful art to pay a visit to the "Exhibition of Swiss Artists," at 168, New Bond Street West.

The Federal Council of Switzerland has passed the Act for controlling gold and silver goods. The adopted standards are:—

For gold: 18 carat. Stamp: *Helvetia.*
14 ,, ,, *Head of a Chamois.*
For silver: 0·875 fine. ,, *A Squirrel.*
0·800 ,, ,, *A Woodcock.*

The agitation for a control originated with the watch-case makers, but it found no favour with the jewellers, in fact they petitioned against it. It is necessary to add that the stamping is compulsory for watch-cases, but *voluntary* for jewellery and silver ware.

The first of a series of Annual Industrial Exhibitions will be held at Brussels from June to October. The exhibits will include goldsmiths' work, jewellery, bronzes, clocks, watches, chronometers, pedometers, clepsydrae and sand glasses, as well as tools and machinery employed in those trades. This Exhibition is International.

Another International Exhibition of Machines and Tools, including those used in the watch-making and jewellery trades, will be held at Altona, near Hamburg, from the 18th of August until the 18th of September.

Mr. Gorham Thurber, one of the principal partners in the Gorham Silverware Manufacturing Company, of Providence, Rhode Island, United States, was among the passengers by the Cunard steamer which arrived last week. His chief object is to find more workmen, chiefly chasers.

Some workmen engaged in forming a new drain on some premises in London Wall came upon a large leather bag or trunk containing 238 gold and silver coins, mostly of the reign of Charles I.; also several pieces of curious plate, among them being a reliquary containing hair, and a goblet of peculiar design. The whole are in good preservation.

A saturated solution of hyposulphite of soda applied with a cloth or brush is mentioned by Dr. Davenport, of the Massachusetts College of Pharmacy, as one of the best means to remove all tarnish from the surface of silver. A solution of cyanide of potassium, as most people know, is also useful for the same purpose (says the *Photographic News*), but, unfortunately, the silver always seems to tarnish more rapidly after its application. In any case, hyposulphite, being comparatively harmless, should be a more popular compound to use.

The total yield of gold in Victoria in 1879 was 758,947 ozs., or less than half the annual average of the colony during the preceding ten years.

To cement alabaster, melt down alum, dip the fractured parts of the article into it, and place them quickly together. When set, clean off the exuded mass.

The celebrated house Louis Audemars, of Brassus, Switzerland, has lost its chief by the death of Mr. A. Audemars. The deceased gentleman was very much respected, and held, besides many important civic offices, the rank of Colonel in the Federal army. He was 75 years of age at the time of his death.

Sir Joseph M'Kenna intends to call the attention of the House of Commons, on the 7th inst., to the artificial causes which have tended to depreciate the value of silver as compared with gold, as well as to the serious consequences of such depreciation.

His Royal Highness Prince Leopold laid the foundation stone of the first Technical College in connection with the City and Guilds of London Institute in Cowper-street, Finsbury, on Tuesday afternoon, the 10th ult. The Prince, in the course of his address, said:—"The object which the institution has proposed to itself is a truly national and patriotic one. (Hear, hear.) It has proclaimed its determination to enter into a generous rivalry with other countries in those branches of trade and commerce in which one must confess that our native industries have of late years not taken the position which we as Englishmen would wish them to occupy. (Applause.) The old apprenticeship system, whatever its merits may be, and whatever good work it may have done in the past, is not equal to the exigencies of the present age—(hear, hear)—and we are beginning to realise that a thorough and liberal system of technical education must be placed within the reach of the British artisan, in order to enable him to hold his own against foreign competition; and when this is done, I believe, as I have said on a former occasion, that we need fear no rivalry in the world. (Applause.)

Observatory time is supplied in Geneva by means of electric clocks, at the yearly rate of 20 francs per dial.

The clocks imported during the month ending April 30th are valued in the Board of Trade Returns at £36,552, whereas during the same period of 1880 the value was £51,492, and in 1879 £48,241. For the first four months of the same years the values are:—1879, £158,346; 1880, £190,184; and 1881, £129,061; thus showing a very considerable falling off for this year. The value of watches imported during last month amounted to £44,344, being a good increase over the same month of last year, when the figures were £29,646, but still less than for April, 1879, when the value was £46,321. The total value for the first four months of this year is £152,030, against, for the same period of 1879, £154,616; and for that of 1880, £125,915.

Messrs. Hildesheimer and Faulkner, publishers, of 41, Jewin-street, E.C., offer £3,500 in prizes for designs and pictures suitable for Christmas and New Year, Easter, birthday, and valentine cards. All designs and pictures intended for this competition must be sent to the gallery of the Society of British Artists, Suffolk-street, Pall Mall East, on July the 26th, between 10 a.m. and 6 p.m. W. P. Frith, R.A.; J. E. Millais, R.A.; and Marcus Stone, A.R.A., have consented to act as judges.

To coat copper or brass objects with silver, without difficulty or loss of time, the following process is given in the *Gewerb.-Bl. f. Ost- u. Westpreussen.* Mix 3 parts of chloride of silver with 20 parts of powdered cream of tartar and 15 parts of powdered common salt. Moisten a suitable quantity of the mixture with water, and rub it with a piece of blotting paper upon the metallic object, which must be thoroughly clean. The latter is afterwards rubbed with a piece of cotton upon which precipitated chalk is dusted, then washed with water, and polished with a dry cloth.

The lockets worn by the twelve bridesmaids at the wedding of Miss Maynard to Lord Brooke, at Westminster Abbey, were costly works of art. Each was formed of diamonds and pearls, worked with the greatest skill into the most exquisite representation of the form and petals of a daisy, appropriate emblems of the youth and innocence of the bride and her bridesmaids, as well as souvenirs of Miss Maynard, the pet name by which she has been known to her family and friends since her birth being Daisy.

Messrs. Geo. Bendon & Co., wholesale and export manufacturers and importers of clocks, bronzes, musical boxes, and optical goods, are now re-established at their warehouses at 36 and 37, Ely Place, and 1, Charterhouse Street, Holborn Viaduct, and offer an extensive and select stock in their various departments.

The stock of Mr. E. D. Johnson, the well-known watch manufacturer, of Wilmington Square, Clerkenwell, was brought under the hammer on the 24th ult., at 21, Old Bond Street, W., but the sale proved anything but satisfactory; in fact out of eighty gold watches, only eight were sold, the bids for the others not reaching reserve prices. Twenty-three silver watches of various descriptions fetched £94 3s. 6d. The total realised for the thirty-one lots was about £200. It is evident that this is not the time for disposing of manufacturers' stocks at fair rates.

The following paragraphs from the Lord Chancellor's "Stolen Goods Bill," concern a great number of our readers:—"6. (1.) A person who buys any gold, silver, or other precious metal, being either old scrap broken or defaced metal, or forming the whole or part of partly manufactured goods or of defaced or old goods or of second-hand watches or jewellery, shall not melt or alter the form of the same until the expiration of not less than seventy-two hours after he brought the same; and every person who carries on the business of dealing in or buying any such gold, silver, or precious metal as aforesaid, shall keep a book containing with respect to all such gold, silver, or metal which is melted or altered in form by him, the particulars specified in the Schedule to this Act, and, when a constable specially authorised as provided by this Act inquires respecting any such article of gold, silver, or precious metal so described by such constable, as to be capable of being by such description distinguished and identified, and stated by such constable to have been stolen, shall examine his books and the articles in his possession for the purpose of ascertaining whether any article corresponding to the description is mentioned in his books or is in his possession, and if he finds any such article, shall inform the constable, and if the article is in his possession shall permit the constable to examine it. (2.) A person who fails to comply with this section shall on summary conviction be liable to a fine not exceeding five pounds, or in the case of a second offence fifty pounds." This Act appears to have been specially framed for worrying pawnbrokers and second-hand dealers, thus we are not at all surprised that the former should have set their well organised trade Association in motion to oppose an Act which can serve no other purpose than to occasionally annoy some members of the trade, and to entail considerable extra labour on all who deal in articles of gold, silver, and other precious metals. The power invested in the police by the Act is very great, and as that useful, though sometimes arbitrary body, is not infallible, this power might often be misapplied to the injury of unoffending people. The Act will never secure the object for which it was intended, to put down burglary by rendering the disposal of stolen goods impossible, for the simple reason that burglars do not sell their booty to pawnbrokers or second-hand dealers, but to men whose callings are not even mentioned in the Act; in fact, the purchaser of stolen property, who, it appears, is known to the burglar only, might belong to any trade. Only the other day a thief got into the clutches of the police, who has now turned traitor and disclosed the name of parties who used to buy the spoils of his gang, and these parties are a *barber and his wife*, keeping a barber's shop in Whitecross Street, E.C. Of course they are now both under lock and key. In this case it was under the *tricolour pole*, and not under the three balls that the thieves found a customer.

The Exhibition of Works of Art applied to furniture, in connection with the Exhibition of Fine Arts at the Royal Albert Hall, was opened on Saturday, 21st ult.

The European settlement at Shanghai is to celebrate its thirty-ninth birthday by the inauguration of an International Exhibition.

Messrs. Richter & Co., mathematical instrument manufacturers, of Chemnitz, Saxony, have found a way of so impregnating thin German silver discs (15 to 25 mm. diameter) with diamond, that, when fitted to a quickly rotating tool, these cut through glass or porcelain in a few seconds, or effect any desired carving with great accuracy. With cylinders made on the same principle, round holes can be quickly and exactly made. The wear of the implement, even after much use, is said to be hardly perceptible.

Sir Bartle Frere, Lady Frere, and their two daughters, the Baroness Burdett-Coutts, Mr. Ashmead-Burdett-Coutts-Bartlett, Mr. D. W. Greenhough (Master of the Turners' Company), Mr. Past-Master John Jones, Mr. Past-Master T. Holtzupffel, Mr. Past-Master R. L. Loveland, Colonel Grant, Mr. J. Murray, Mr. H. Rhodes (discoverer of the celebrated "Rhodes" diamond), and a number of other ladies and gentlemen, on the 25th ult., visited the diamond-cutting and polishing works of Messrs. W. Ford & Co., Clerkenwell Green, and spent about an hour in witnessing the various processes employed in the work. Sir Bartle Frere delivered an interesting lecture on his experiences of the diamond-fields at Kimberley, which, he stated, cover an area of more than fifteen acres, and are at present worked to a depth of 370 feet. In his opinion, the African diamond industry had before it a prospect of long duration. We are pleased to see that Mr. William Ford meets with so much encouragement and influential patronage, as he is well deserving of it; for it is to him that we owe the establishment of diamond-cutting as an English industry. We gave a full description of his interesting and well-appointed factory in an earlier number of this journal.

SOFT PINIONS, ETC.

TO THE EDITOR OF THE WATCHMAKER, JEWELLER, AND SILVERSMITH.

Sir,—Most retail watchmakers must have noticed the very short time that a new English lever watch will go without the centre bottom and fusee top pivots being very seriously worn, in many instances to really good watches not more than three or four years. At one time I was disposed to think that it was the very thin oil that many are fond of using—so thin that it quickly dries up—was the cause; but further observation leads me to conclude that it is partly owing to the pinions and fusee steel being left much too soft. If this view is a correct one, it seems to be a matter to which the movement makers and watch manufacturers should pay special attention. That these worn parts are to be found more frequently in modern watches than in very old ones (when the reverse should be the case) is the experience of most watchmakers who have many good old watches passing through their hands for cleaning.

With the keen foreign competition our manufacturers have, the long-lasting, durable watch that Englishmen are so fond of terming their production should not lose its reputation; but if these defects continue, it must soon cease to be looked upon as a serviceable, wear-resisting article. Trusting these few remarks will have the effect of drawing the attention of those most interested in the subject to it,

I am, Sir, your obedient servant,

J. D. Fisher.

228, High Street, Lincoln.

LECTURES ON WATCH AND CLOCK MAKING,

PREPARATORY FOR THE ELEMENTARY EXAMINATION OF THE CITY AND GUILDS OF LONDON INSTITUTE IN MAY, 1881.

DELIVERED AT ST. THOMAS CHARTERHOUSE SCHOOL BY I. HERRMANN, ON MONDAY EVENINGS FROM OCTOBER 25TH.*

(*Continued from page* 147.)

THE discs shown in fig. 25, page 131, represent the ratio of the rotary velocity of one wheel to the other. If we subdivide the rotation of each disc, their fractions will be in the same ratio as their whole; that is, since A : B : : 2 : 1, B will make one turn while A makes one-half, and hence B will move through an angle of 2°, while A moves through an angle of 1°, and so on, and however minute the angles may be, they maintain this constant ratio. It is this condition that forms the basis in determining the forms of teeth, etc., and is called "uniform lead."

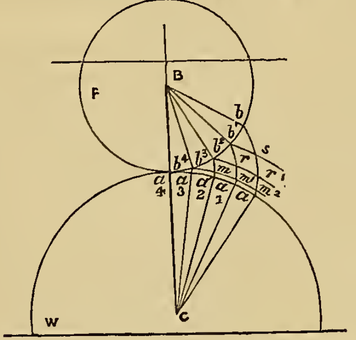
On examining a depth, it will be at once apparent, that the conditions of "uniform lead" are confined within the period or angle of engagement of one tooth and the corresponding leaf of the pinion, because if the numbers of teeth and leaves are in ratio of the circumference of A to that of B (fig. 25), then each period or angle formed by too adjacent pinion leaves, must be equal to every other of the same pinion, and every angle contained between the face of one tooth and the next, must likewise be equal to any other, and hence—

$$\frac{360^\circ}{\text{number of pinion}} : \frac{360^\circ}{\text{number of wheel}} :: \left\{ \begin{array}{l} \text{radius of wheel} : \\ \text{radius of pinion.} \end{array} \right.$$

That is to say, given that the wheel and pinion are true and equally divided, the commencement of contact of a tooth and its corresponding leaf, and the point where that contact ceases, will always be exactly in the same position, and hence, likewise, the chords of these points must be equal.

If, however, this angle is again subdivided in smaller or minute divisions, they will be regular or irregular, according to form of teeth and number of pinion leaves.

FIG. 26.



Let fig. 26 represent the pitch circles of a wheel and pinion; W a wheel of ten teeth, and P a pinion of six leaves.†

Let radius of W = C a = 1, and of P = $\varkappa$, then we have

$$10 : 6 :: 1 : \varkappa$$

and—

$$\varkappa = \frac{6}{10} = \cdot 6$$

In a pinion of 6 the angle of contact of each leaf with the corresponding tooth, measured from the pinion centre—

$$= \frac{360^\circ}{6} = 60^\circ = b^4 \text{ B } b$$

Let the corresponding angle of the wheel = $\varkappa$, then—

$$10 : 6 :: 60 : \varkappa$$

and—

$$\varkappa = \frac{60 \times 6}{10} = 36^\circ = a_4 \text{ C } a$$

Also let the angle b^4 B b, be divided into four equal parts, then angles b^4 B b^3, b^3 B b^2, b^2 B b^1, and b^1 B b respectively will each be $= \frac{60^\circ}{4} = 15^\circ$; and again, let the angle a_4 C a, be divided into four equal parts, then angles a_4 C a_3, a_3 C a_2, a_2 C a_1, and a_1 C a respectively will each be $= \frac{36^\circ}{4} = 9^\circ$.

An inspection of fig. 26 will show, that if a line is drawn from C to B, called the line of centres, the point where this line cuts, W and P must be the point where they touch, but the only point where they do touch; hence it is evident that the contact does not take place nearer to the wheel centre than its pitch circle.

Again with uniform lead, a, a_1, a_2, a_3, and a_4, respectively represent four consecutive positions of the face of one tooth drawn to the pitch circle during its angular movement of 9°, and b, b^1, b^2, b^3, and b^4, respectively represent four positions of the face of a pinion leaf in its angular movement of 60°.

But the angle b^4 B b is the pinion angle of contact with one tooth of the wheel, and the angle a_4 C a is the wheel angle of contact with one leaf of the pinion; therefore since b B represents the face of one leaf, b^4 B must represent the adjacent leaf; and as a C represents the flank of one tooth, a_a C must represent the other.

Again motion has to be communicated from W to P, and in such a manner that a pinion leaf is moved from b^4 to b, while the corresponding tooth moves from a_4 to a. In order then, that this effect be produced, some addition must be made to the tooth outside the pitch circle, that it may remain in contact with the pinion to point b, and of such a form, that the face of the tooth moves to a, while the pinion leaf moves to b.

This addition or projection of a tooth is generally called "Addentum," and sometimes, as in "Saunier's Treatise," "Ogive." A further reference to fig. 25 will show some of its properties.

If we join b^3 with a_3, we trace approximately the form of an addentum required to maintain uniform lead for the angle b^4 B b^3. Let m a_2, m^1 a_1 and m^2 a be equal to b^3 a_3 in magnitude and direction.

Again, join b^2 m, and make r m_1 and r^1 m_2 equal to b^2 m. Also join b^1 r, and make s r^1 equal to b^1 r, and lastly join b s. If instead of taking four positions only, we take a great number, the sections represented here (on a large scale) by a m^2, m^2 r^1, r^1 s, and s b become very small and form a continuous curve. This curve is a section of the curve called the epicycloid.

The cycloid is a curve traced by a point in the circumference of a wheel rolling on a plane surface, and an epicycloid is a curve traced by the same, or any wheel rolling on the circumference of another wheel.

We cannot enter into the particulars of its properties or method of construction. There is, however, one important point which bears on its application that is necessary to be noticed.

There is a general agreement among horological authorities, that the breadth of a tooth measured at the pitch circle should be equal to the space.

Let a d l c, fig. 27, represent a tooth equal to either space l c m n or a d o r; a and b are points in its pitch circle.

If a disc started rolling from l in the direction of a, and from *a* in the direction of *l*, it would trace two curves; let *a s* represent one section, and *b t* the other. They would cut each other in some point; let that point be *g*, then *a g l* is the addentum.

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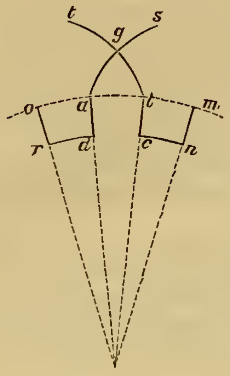
† To take a wheel of 10 to a pinion of 6 appears a departure from the rule of practice; it is done, however, to avoid such a departure. Generally we use wheels of 50 to 60 teeth, but it would not be convenient to represent the several points in the lead of a wheel and pinion of such a ratio by a reasonable sized diagram. The principle holds good whatever the relative numbers may be; hence by taking this proportion we represent a condition and a principle, whereas by taking a wheel of 60 we could only represent a principle by a departure from the actual condition.

FIG. 27.



The disc or circle that would be used to trace this curve, is called the generating circle, and the point in its circumference which describes it, is called the generating point; *l* is the origin of *l g*, and *a* of *a g*.

Now it is the radius of the generating circle which determines the position of *g*. As the curve is traced with a larger generating circle, *g* will be at a greater distance from the pitch circle of the wheel, and with a smaller it will be brought closer. But the position of *g* in relation to the pitch circle of the wheel is important. As we shall see, it is necessary that the contact of a tooth and pinion leaf should commence at the line of centres or as near as possible.

To realise this in a depth with a pinion of 6, it will require that the height of the addentum should be such that it will carry the pinion leaf with which it is in contact to an angle of 60° with the line of centres, and in proportion as the contact ceases at any angle less than 60°, by reason of the position of *g*, have we contact before the line of centres.

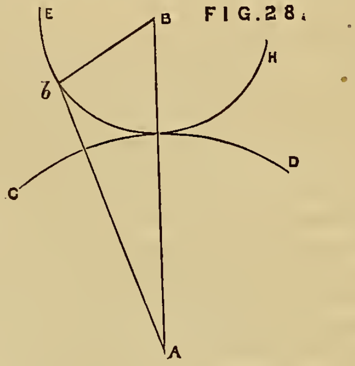
On this matter, however, authorities differ. "Saunier"[*] follows the course of engineers, and defines the proper radius of the generating circle as equal to half of a pinion of 6. If we take the breadth of a tooth = 1, this would give the height of the addentum = ·887.[†]

He allows, however, a modification to this rule for lower number pinions.[*]

M. Grossmann gives the average height equal to the breadth. The radius of generating circle for this curve would be ·7.[†]

It is not my business to pronounce any decision in this matter, but simply show what must be the absolute effect.

FIG. 28.



Let A B, fig. 28, be the line of centres of a wheel and pinion, and let C D = the pitch circle of a wheel of 60 teeth, with radius = 10, and E H the pitch circle of the pinion, then pinion radius—

$$= \frac{10 \times 6}{60} = 1$$

b A being = 10·464, and the line of centres A B = 10 + 1 = 11.

Then with an addentum whose curves have been described by a generating circle, with radius = ½ the radius of a pinion of 6, the $\angle$ *b* B A will be approximately 49° 30′, and,

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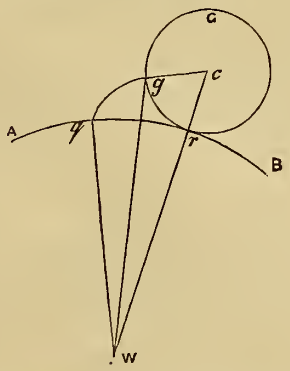
[*] Article 1086.

FIG. 27*a*.



[†] Let A B, fig. 27*a*, represent a section of the pitch circle of a wheel of 60 teeth, whose radius = 10, and let G represent the generating circle. Then radius of G—

$$= \tfrac{1}{2}\ \frac{10 \times 6}{60} = \cdot 5$$

Let *g* be the origin of the curve *q g*, and *g* the generating point. When the generating circle G has rotated through an angle of 84° 40′, required to know the distance of *g* from A B.

Let the angle *q* W *r* = ♓, then—

$$10 : \cdot 5 :: 84^\circ\ 40' : ♓$$

$$♓ = \frac{84^\circ\ 40' \times \cdot 5}{10} = 4^\circ\ 14'$$

Tangent *g* W C.

$$= \frac{\text{Sine } 84^\circ\ 40' \times \cdot 5}{10 \cdot 5 - \text{Cos. } 84^\circ\ 40' \times \cdot 5}$$

$$= \text{Log. } \bar{1} \cdot 6970825 - \text{Log. } 1 \cdot 0192865 + 10$$

$$= 8 \cdot 677796$$

$$= \text{tang. } 2^\circ\ 44'$$

$$\therefore \angle q\, W\, g = 4^\circ\ 14' - 2^\circ\ 44' = 1^\circ\ 30'$$

Since in a wheel of 60 teeth the angle contained between the radii drawn to the flank and point of a tooth $= \frac{1}{2}\ \frac{360'}{120} = 1^\circ\ 30'$, it is proved that this is the right position of *g* in relation to its angle of revolution about W; hence it must be right for its distance from W, and hence also *g* represents the point of the tooth.

Let distance of *g* from A B = ♓

then— $♓ = \left(\text{Sec. } 2^\circ\ 44' \times (10 \cdot 5 - \text{Cos. } 84^\circ\ 40'\ \cdot 5)\right) - 10 = \cdot 464.$

Span or breadth of a tooth = 2 Sine 1° 30′ × 10

$$= \cdot 0261769 \times 2 \times 10 = \cdot 523$$

then— 523 : 464 :: 1 : to height

$$= \frac{464}{523} = \cdot 887$$

[*] Article 1128.

[†] Let A B (fig. 27*a*) = pitch circle of a wheel of 60, with radius = 10. G = generating circle with radius = ·7.

Let $\angle g\, C\, W = 73^\circ\ 35'$

then $\angle q\, W\, C = \frac{73^\circ\ 35' \times \cdot 7}{10} = 5^\circ\ 9$

tang. *g* W C.

$$= \frac{\text{Sine } 73^\circ\ 35' \times \cdot 7}{10 \cdot 7 - (\text{Cos. } 73^\circ\ 35' \times \cdot 7)} = 3^\circ\ 39'$$

$\therefore \angle q\, W\, g = 5^\circ\ 9' - \overline{3^\circ\ 39' = 1^\circ\ 30'}$ and height of addentum

$$= \left(\text{Sec. } 3^\circ\ 39' \times (10 \cdot 7 - \text{Cos. } 73^\circ\ 35 \times \cdot 7)\right) - 10 = \cdot 523.$$

therefore, the angle of engagement before the line of centres $= 60° - 49° 30' = 10° 30'$.*

By M. Grossmann's definition the height is—

$$\frac{10 \times 2 \times 3{\cdot}1416}{120} = {\cdot}5236$$

With this addendum, the angle b B A will be approximately 58°, and therefore the angle of contact before line of centres $= 60° - 58° = 2°$.†

The height of the addendum is of importance in low number pinions in relation to the angle of contact before the line of centres, but uniform lead can only be obtained with high number pinions. An inspection of fig. 26 will show that the conditions of uniform lead demand that contact should take place at the end of the face of the pinion.

In pinions of 6, 7, and 8, the point leads; hence the motion of the wheel is too slow for the first part of the contact, and too quick at the end, where the rapid sliding of the point on the face of the pinion takes place. This proves the fact that the addendum of wheel should be constructed according to the number of leaves in the pinion it has to gear into.

As we increase the number of pinion leaves, the distance of the extremity of the face of the pinion leaf from the centre of the wheel when it ceases contact becomes less. Thus, for example, if b, fig. 26, represents this point in a pinion of 6, s would represent it for a pinion of 7, r^1 for pinion of 8, and m^2 for a pinion of 10, that is in principle, and hence the section $b\ s\ r^1$ would not be needed in the last case.

Thus far we have only analysed the conditions between a tooth and the follower, we may call this simple contact. In all depths, however, there is a compound action, that is, the action of one tooth and the corresponding leaf has to be taken or determined in relation to the next pair coming in action. With a given wheel this is directly effected by the size of the pinion and the magnitude of the line of centres, but to see the importance of this effect it is necessary to examine first the condition of the contact of pinion leaf and tooth before the line of centres in relation to the transmission of force or the modulus of a depth.

(To be continued.)

NOTICE.—Continuation of "Repairing Swiss Watches," by H. Ganney; "Bronzes"; and several other articles which had to be held over will appear in our next.

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* Let the angle b B A (fig. 28) $= 49° 30'$; then the angle b A B $= 90° - 49° 30' - \left(\text{angle Cos. } \frac{\text{Sine } 49° 30' \times 11}{10{\cdot}464}\right) = 90° - 49° 30' - 36° 56' = 3° 34'$; and Log. b B = Log. Sine $3° 34'$ + Log. $11{\cdot}464$ — Log. Sine $49° 30'$ = $8{\cdot}7938594 + 1{\cdot}0593362 - 9{\cdot}8810455 = \text{Log. } \bar{1}{\cdot}9721501 = \text{N. } 9379$; then Sine $\frac{1}{2}$ b B A

$$= \sqrt{\frac{(\frac{1}{2}\ \overline{10{\cdot}464 + 11 + {\cdot}9379} - 11) \times (\frac{1}{2}\ \overline{10{\cdot}464 + 11 + {\cdot}9379} - {\cdot}9379)}{11 + {\cdot}9379}}$$

$$= {\cdot}41560 - \text{N.S. } 24° 34'$$

$$\therefore \angle\, b\text{ B A} = 24° 34' \times 2 = 49° 8'$$

$$\text{Log. Tang. (Log. Sine } 10° 30' - \text{Log. } \overline{11 - \text{Cos. } 10° 30'})$$

$$= 8{\cdot}159938 = \text{Tang. } 50'$$

but $3° 34' + 50' = 4° 24'$

$\therefore \angle\, 10° 30'$ is the minimum angle of contact before line of centres.

† Let b B A (fig. 28) $= 58°$; then b A B

$$= 90° - 58° - \angle\ \text{Cos. } \frac{\text{Sine } 58° \times 11'}{10{\cdot}5236} = 90° - 58 - 27° 35'$$

$= 4° 25'$; and Tang. b B A

$$= \frac{\text{Sine } 4° 25' \times 10{\cdot}5236}{11. - (\overline{\text{Cos. } 4° 25' \times 10{\cdot}5236})}$$

$$= \text{Log. T. } 10{\cdot}2019636 = 57° 53'$$

$$\text{Log. Tang. (Sine } 2° - \text{Log. } \overline{11 - \text{Cos. } 2°})$$

$$= \text{Log. } 7{\cdot}5428192$$

$$= \text{Tang. } 12'$$

but $4° 25' + 12' = 4° 37'$

$\therefore \angle\, 2°$ is the maximum angle of contact before line of centres.

THE DISCRIMINATION AND ARTISTIC USE OF PRECIOUS STONES.*

By PROFESSOR A. H. CHURCH, F.C.S.

(Continued from page 154.)

IT may be useful, as an introduction to the study of individual precious stones, to say a few words concerning the physical experiments by aid of which qualities can be best ascertained and discriminated, where, in fact, we cannot employ wholly trust to the eye. The materials required for such experiments are very simple, and include—

a. A set of mineral fragments—diamond, sapphire, spinel, chrysoberyl, topaz, garnet, and quartz—to be used as tests for relative hardness.

b. A small pocket spectroscope, by which absorption-bands as those of the garnet and jargoon, may be detected.

c. A dichroiscope, or double image prism, suitably mounted, by which the pleochroism, or difference of colour in the light transmitting in different directions in the same stone, may be ascertained.

d. Liquids or easily fusible solids, of high specific gravity, from 2·3 upwards, by means of which the detection of different densities in doubtful specimens may be easily accomplished.

The applications of this critical apparatus to the discrimination of certain precious stones will be mentioned further on, in connection with particular species. But a few lists or tables of the hardness, pleochroism, and specific gravity of some of the more interesting and valuable of precious stones will be useful here. Such tables are more convenient for practical and ready use when arranged in a kind of progressive order, such as I have adopted. The hardness assigned to the different species, or varieties, must be taken as average or approximate only. The terms used to designate the differing colours of the oppositely polarised beams in dichroic stones are the best I could select, but refer merely to the specimens examined. The table of specific gravities contains a selection from about 200 specific gravities, taken by myself with unusual precautions.

TABLE OF HARDNESS.

Diamond	10·0	Iolite	7 3
Sapphire	9·0	Cinnamon stone	7·0
Ruby	8·8	Jadeite	7·0
Chrysoberyl	8·5	Amethyst	7·0
Spinel	8 0	Jade	6·5
Topaz	8·0	Peridot	6·3
Aquamarine	8 0	Moonstone	6·3
Emerald	7·8	Green garnet	6·0
Zircon	7·8	Turquoise	6 0
Tourmaline	7·5	Opal	6·0
Phenakite	7·5	Lapis-lazuli	5·0
Almandine	7 3		

TABLE OF PLEOCHROIC STONES.

Name of Stone.	Twin Colours.	
Sapphire, blue	Blue	Greenish straw.
Ruby, red	Aurora red	Carmine red.
Tourmaline, red	Salmon	Rose pink.
,, brownish red	Umber brown	Columbine red.
,, brown	Greenish yellow	Orange brown.
,, green	Pistachio green	Bluish green.
Emerald, green	Yellowish green	Bluish green.
Topaz, sherry	Rose pink	Straw yellow.
Peridot, pistachio	Sea green	Brown yellow.
Aquamarine, sea green	Grey blue	Straw white.
Beryl, pale blue	Azure	Sea green.
Chrysoberyl, yellow	Greenish yellow	Golden brown.
Iolite, lavender	Indigo blue	Pale buff.
Amethyst, purple	Bluish purple	Reddish purple.
Tourmaline, blue	Indigo blue	Greenish grey.

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* A lecture delivered at the Society of Arts

TABLE OF SPECIFIC GRAVITIES.

Zircon:—	
Jacinth (Espaly)	4·863
Columbine red	4·705
Green	4·691
Brown	4·696
Red Brown	4·651
Brown Yellow	4·620
Yellow	4·600
Orange yellow	4·362
Dull green	4·020
Garnet:—	
Red	4·059
Yellow green	3·854
Emerald green	3·849
Pistachio green	3 848
Cinnamon stone	3·666
Cinnamon stone	3·642
Sapphire:—	
Yellow	4·030
Yellow	4·006
Blue and white	3·979
Chrysoberyl:—	
Golden yellow	3·840
Yellow	3·760
Brown yellow	3·734
Spinel:—	
Indigo	3·715
Indigo	3·675
Puce	3·637
Rose	3·631
Puce	3·592
Aurora red	3·590
Olivine:—	
Peridot	3·389
Topaz:—	
White	3·597
White	3·571
Wine yellow	3·540
Tourmaline:—	
Green	3·154
Black	3·124
Red	3·044
Red brown	3·009
Beryl:—	
Emerald	2·704
Aquamarine	2·702
Blue	2·701
Yellow	2·697
Brown yellow	2·690
Quartz:—	
Milky	2·642
Pure Rock Crystal	2·650
Brown Cairngorm	2·656
Amethyst	2·659
Very dark Amethyst	2·662
Adularia:—	
Moonstone	2·585

It has been no easy matter to decide upon the order in which the several most important precious stones should be discussed. In a chemical paper, a classification in accordance with composition would be absolutely right; while such physical properties as hardness and specific gravity might be made prominent features in the arrangement of the species in a physical paper. But as the ornamental or artistic employment of precious stones conveys primarily, if not wholly and ultimately, an appeal to the eye, it is clear that such optical properties as can be comprised in the terms colour, lustre, and light should afford the bases of our classification. On the whole, the prominent feature of precious stones is their colour, and the easist way of considering their colour is to adopt the order of succession of the colours in the ordinary rainbow or prismatic spectrum, beginning with the white light from which they all spring.

White Stones.—The diamond naturally takes the first position if we consider its hardness, its remarkable composition, and its strong refraction and dispersion of light. Its properties, so far as they appeal to the eye, differ much from those belonging to the majority of other stones, and it forms, partly in consequence of this peculiarity, as good a border or setting to other jewels as a gold frame does to a picture. Of course much depends upon the quality of the diamond, and much upon the shape which is given to it by the lapidary. The flat plates of *lasque* diamonds, and, in less degree, the step-cut stones with broad tables, exhibit the unique and splendent lustre which is peculiar to the polished surface of this stone; these forms also permit the transparency and the total internal reflection of light to be well seen. Even the form of the diamond crystal, the regular octohedron, when its surfaces are really planes, well exhibits the transparency and reflection of the stone.

This seems the place to raise a protest, which, indeed, I have done on many previous occasions, against the ignorance and narrowness which would condemn diamonds and all other stones, irrespective of all the optical differences which they present, to be cut *en cabochon* or tallow-topped, that is, with a convex rounded surface. A certain clique of artists and amateur writers on art insist upon all stones being cut in this way, which, in the majority of cases, is fatal to the development of those optical qualities upon which the beauty of precious stones mainly depends. Indeed, the facetting of the great majority of transparent stones is not only a necessary operation, but it should be done in strict accordance with certain rules of proportion, which may be deduced from the optical constants of the species of stone operated upon. But with pale and defective specimens, the *cabochon* form is often found more suitable than the rose, or brilliant, or stepcut; and it is the only method of showing to advantage the peculiar beauties of a large number of translucent, chatoyant, or opaque stones, like the chrysoprase, the opal, the moonstone and the cat's-eye.

Next to the diamond, we may place the colourless zircon or jargoon, then the phenakite, then the white sapphire, the white topaz, and the white beryl. Rock crystal will come below these in point of beauty and brilliancy. The colourless zircon (of which a fine specimen set in a ring may be seen in the British Museum Mineral Gallery, now at South Kensington) approaches very near in prismatic brilliancy to a diamond; so, at night especially, does the rare and curious mineral phenakite. There is, however, always a sort of difficulty in finding an appropriate use for colourless, yet lustrous, stones in any article of jewellery intended for personal adornment. The more lustrous and prismatic they are—the more they resemble the diamond in fact—the less available are they for the usual purpose to which gems are put. Still, there are peculiar qualities in these stones which need not be lost to artistic employment, if the white stones in question were judiciously associated with materials which would prevent their being mistaken for diamonds. A white diamond would rarely or never be bordered by green tourmalines, but these stones would form an agreeable combination with a white zircon, a phenakite, or a white topaz. In the sapphire there is usually a faint suspicion of milkiness, and in the white beryl a cool greyish tint, which prevent these stones from resembling the diamond so closely as to be taken for imitations of that gem. But many of these colourless stones, notably the topaz and rock-crystal, in all probability are most appropriately used when set as bosses in vessels, and other large pieces of metal-work, or employed in the form of plaques for engraving or etching. It is scarcely necessary to justify such uses of these minerals, and this is not the place to enter upon the question, particuliarly as it is only by a rather wide use of the term precious that I am able to include these materials, and some others of which I shall have to speak presently, amongst precious stones. Of two other white materials employed in jewellery, the moonstone and the pearl, a few words may be introduced here. The moonstone forms an excellent substitute in many combinations for the pearl, but it does not associate quite so well as the latter with the diamond. With deep-coloured amethysts, spinels, and tourmalines, few colourless gems look more refined than the moonstone. But these stones, which fetch a shilling or so apiece only, should always be accurately re-cut and highly re-polished before being used. Their forms are too irregular, and their surfaces too imperfect, as imported from Ceylon, to show off their moonlight sheen with half its intensity, unless they are passed again under a careful lapidary's hands. The improvement thus effected is marvellous. The value of the pearl, whether its "orient" be luminous with prismatic hues, or whether it be a warm, soft white merely, is too well known to be more than named in this connection. But I may be permitted to say one word in deprecation of the extravagant expenditure of time, of ingenuity, and of costly materials, which the attempt to convert large irregular pearls into structures resembling figures has so often caused. The result is nearly always most unhappy.

(*To be continued.*)

We have much pleasure in informing our subscribers that this Journal will undergo further improvements with our *seventh year, commencing with July number.* It will be permanently illustrated with first-class designs for jewellers, silversmiths, etc.

CONSTRUCTION OF TIMEKEEPERS DELIVERED TO THE BOARD OF LONGITUDE, MARCH 7, 1805.

Earnshaw's Escapement.*

(Continued from page 152.)

Q. What is the length of the balance-spring in your box-timekeeper, and what in your pocket-timekeeper.

A. About the usual length of Arnold's, various as his are, from 12 to 20 inches in box-timekeepers, and in pocket ones from 5 to 7 inches, just as I can get the wire to answer the purpose.

Q. Are your balance-springs made of soft steel or tempered? And if tempered, in what manner?

A. My balance-springs are made of soft steel rolled hard, and not hardened with heat and cold, that process not being at all necessary.

Q. How is the balance-spring turned into its proper shape?

A. It is turned round a brass cylinder, and then blued by heat, which sets it into the cylindrical form.

Q. Explain what you mean by this? And how it is performed?

A. All watchmakers know how to draw and taper balance-springs, though they did not know how much they were to be tapered to that certain degree which could only answer the purpose of a complete timekeeper. I perform it in the following menner: Take a length of balance-spring wire, say about 12 inches for box-timekeepers, and draw it between two smooth potence files, beginning from the end about one-sixth of its length, make one draw; the next about two-sixths, and so on, advancing one-sixth every draw till you come to the top, pressing the files just so hard together as will make them bite or take hold of the spring; do the same with two oilstones, only give twelve strokes instead of six, which will take off all burrs which the file left on.

Q. As you say that the balance-spring will continually lose of its power by use, is there any method of restoring it to its original strength?

A. By giving it rest.

Q. How is the watch made to vibrate one-third of a circle, or a circle and a-quarter, or confined to a circle and a-quarter?

A. Make the timekeeper in all its parts as described and it will produce this vibration, one circle and a-quarter; if not so much, the balance must be lightened, or a stronger main-spring put in, whichever is most convenient; but if it vibrates more, then turning the small pallet a little nearer to the face of the large pallet, so as to give the scape-wheel a little more drop, will shorten the vibrations; or setting the detent spring in a little stronger will likewise shorten them.

Q. If a spring after being applied to a timekeeper is found not to render it correct, can the same spring be altered to correct it? And if so, how performed?

A. It may be altered, but I advise making another. Every beginner must expect to have some little loss at first; but in a short time, by habit and attention, he will be able to make them so near that if they are not quite exact they will be exact enough for timekeepers of inferior prices, and the maker will be able to accommodate various purchasers who will not give the highest price.

Q. Does altering the length of a balance-spring, of uniform thickness throughout, alter the performance of a watch in any other way except that of making it gain or lose on mean time?

A. I never used the lengthening or shortening the spring for any other purpose but that of making the watch gain or lose. Le Roy published, many years back, that a certain length would produce isochronism; and Arnold says, he has used it for that purpose. I use a method truly English, contrived by myself, and produce isochronism by tapering.

Q. Is there any particular nicety in making the detent-springs? How are they brought to their proper shape, hardened, tempered, etc.? What alteration will take place in the performance of the watch, in consequence of any alteration in the stiffness of those springs?

A. As the detent-spring is to fall into the teeth of the scape-wheel to stop it at every tooth, it should be no stronger than just necessary to do so; and such strength can be obtained by any watchmaker looking at one and trying its strength with the finger; and indeed they can hardly make them too weak so they do not cockle. They are brought to their proper shape by files, and afterwards smoothed with a piece of steel and oilstone powder. I do harden and temper them. If the spring is stronger than necessary it will produce friction and impede the motion of the balance; for, as the swing of the balance is to unlock the wheel, by moving the spring out of it, it is sixteen times more easy for the balance to move a spring of the force of one ounce than one of the force of one pound; therefore, a detent-spring too strong is a great evil, and they can hardly be made too weak; and it is perfectly easy in the making to find the right strength.

Q. How should the lifting and large pallet be placed with respect to each other? And how are these pallets made and adjusted? As the unlocking of the wheel depends upon the relative situations of the lifting and large pallets, what alteration will take place in the performance of the watch by varying the positions of those pallets?

A. The lifting and large pallets are twisted on the same round axis, and may be moved with ease into any circular direction to each other, and the small lifting pallet must be moved round to such position that when the wheel is unlocked the face of the large pallet should be just within the compass of the wheel-tooth which is to act on it. The pallets are made of steel, and jewels set in them for the acting parts. The effect produced by not setting these two pallets right is fully explained in an answer to a previous question.

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* Earnshaw's own description from "Smith's Compendium of Practical Inventions." Liverpool, 1816.

ON THE FLUCTUATIONS IN THE RELATIVE VALUES OF SILVER AND GOLD, WITH SPECIAL REGARD TO THE PRESENT DEPRECIATION OF SILVER IN INDIA.*

By Edward J. Watherston.

(Concluded from page 150.)

WHILE England is the only country which, fully and practically, has adopted the gold standard and "demonetised" silver, the rest of the nations of the world have either kept to the double standard, existing from the most ancient times, or have the silver standard alone. Tending towards the gold standard, however, though not as yet absolutely adopting it, is Germany. The powerful military empire which now commands the political fortunes of Europe has been led upon this path by circumstances prevailing nowhere else. Previous to the war against France, the thirty states into which Germany was divided had, for currency, mainly a debased coinage called silver by courtesy, but in reality brass, the baser metal being covered by but a thin film of silver. Scarcely in one state of Germany would traders accept the brass-silvered coins of the neighbouring duchy, or principality, and this necessarily led to immense complications and restrictions of trade. One of Prince Bismarck's first objects, when once he had established the unity of the "Vaterland," was wisely directed towards instituting also a unity of coinage, and it was solely with this aim before him that he, with the sanction of the legislature, organised a new imperial currency, under the stipulation that all the old debased coins of the various states should gradually be withdrawn from circulation. The new coinage was made chiefly gold, owing to the fact that France had paid her war indemnity of £200,000,000 chiefly in that metal. Supplied by the golden stream, or rather torrent, which wealthy France poured upon her victorious enemy, the Imperial German Mint has coined about £95,000,000 in gold from 1871 to the present time. But the Imperial Mint likewise coined, during the same period, £98,000,000 in silver, and the silver currency would have made even larger progress had it not been found that it was not required. By a law passed July 9, 1873, the coining of silver, which at that date had reached a total of £98,000,000 sterling, just mentioned, was momentarily stopped while the coining of gold continued. But by no law as yet passed was silver "demonetised" and gold made the sole standard of value. It is rumoured, it is true, that this is the ultimate intention of the Imperial Government; but the rumour strongly requires confirmation. Germany is simply waiting to come to a decision in the "battle of standards." The decision will depend greatly, if not entirely, upon the future proceedings of that powerful combination of states, united for purposes of currency, known as "The Latin Monetary League."

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* A paper read at the Social Science Congress, Edinburgh.

It was the wisdom of some far-seeing French statesmen and political economists, who had deeply studied all questions of international finance and commerce, which led to the foundation, in 1867, of "The Latin Monetary League." Its primary object was the unification of the currency of the principal states of western continental Europe, the "franc" or "livre" of France, with its decimal divisions, being adopted as the common coins.

The governments of France, Belgium, Italy, and Switzerland formed "the League," which was subsequently, in 1875, entered into by Greece. But beyond the unification of the currency, there was something else in the object of the founders of "The Latin Monetary League." They saw—more clearly than most of our own statesmen had yet been able to see—that the existing condition of things as regards the measurement of "value" by the relative price of two metals, gold and silver, was entirely unsatisfactory, and they attempted to supplant it by another. It was admitted to be a provisional remedy only, and therefore established only for a fixed term, ending, in the first instance, with 1880. The essence of the system of the "League" of 1867 was that the states forming part of it should adopt a "bi-metallic" or "double standard" currency, and that it should be settled annually, in common conference, to what amount silver should be coined, the object being, of course, to prevent the depreciation of this metal. The amount fluctuated in various years between 4,800,000*l.* and 6,200,000*l.*, and the result obtained was, that in the states forming the "League," the relative values of silver and gold, fixed at 15½ to 1, did not change to any appreciable extent. So far the original aim was accomplished, notwithstanding that the French Government somewhat hazarded the future by declining, in 1874, any longer to coin silver on private account, though not refusing to let gold, thus offered, enter its mints. As matters stand at this moment, the "Latin Monetary League," designed to be only temporary, is a rather fragile body, yet with it rests, nevertheless, to a great extent, the decision as to what shall be the settled medium of exchange of the nations of the world. Should the "League" finally and definitely declare itself for the "double standard," there is very little doubt that almost all nations, even Great Britain included, must follow suit. On the other hand, if the "League," after the example of Great Britain, should finally adopt the gold standard, and "demonetise" silver, there can be no less a doubt that silver is doomed, since the quantities of it thrown on the market will be so enormous as to depreciate the formerly "precious" metal to an extent that we may, as the knight in the old ballad, shoe our horses with silver.

It is almost needless to dwell upon the effects of an immense depreciation of silver, say down to one-half of its present value, upon our commercial and no less our political relations with India alone, leaving other countries now adhering to the silver system out of the question. According to the most reliable estimates, the metallic currency of the world amounts, at present, to about 1,550 millions sterling, comprising 800 millions in gold and 750 millions in silver. Therefore, should silver become "demonetised" universally, as it has been already in Great Britain—and as might occur should the "Latin Monetary League" follow the example of Great Britain—the almost immediate effect would be to reduce the currency of the world by nearly one half. The evil result of this reduction of currency, in the depreciation of silver, would fall chiefly on our own country, since we are, including our colonies and dependencies, by far the largest holders of silver among the nations of the earth. This is a most important point, but one which seems to be either overlooked or entirely ignored by many of our leading statesmen. On the basis of the most reliable estimates, it may be calculated that very nearly one-half of the total silver currency in existence, say 350 millions sterling, is in the hands of the 240 millions of inhabitants of our Indian Empire; part of it is hoarded, and another part, the greater, is in circulation. It is probable that China, too, with which our commerce is extensive, has absorbed at least another hundred millions sterling in silver coin on the European fringe of the Empire, with its 362 millions of inhabitants. These figures in their immensity but shadow forth the calamity that would be inflicted upon British commerce by the constant depreciation, with gradual extinction, which must come in the end, of the legal silver currency. Whatever arguments the advocates of the exclusive "gold standard" may put forward, they cannot get over the one fact, so succintly proclaimed by Mr. Bagehot before the Parliamentary Committee of 1876, that "silver is the normal currency of the world."

Besides the mighty interests involved in the prosperity of our Indian Empire, coupled with our vast commerce with Asia in general, England has special reasons to dread a depreciation in the value of silver, as being the great carrier of the "precious" metal for the whole world. It is a huge traffic, as will be seen from the following table which gives the total value, in round numbers, of the imports and exports of silver, both bullion and specie, into and from the United Kingdom in each of the 22 years from 1858 to 1879:—

Year.	Imports of Silver £	Exports of Silver £
1858	6,700,000	7,062,000
1859	14,772,000	17,608,000
1860	10,394,000	9,893,000
1861	6,583,000	9,573,000
1862	11,753,000	13,314,000
1863	10,888,000	11,241,000
1864	10,827,000	9,853,000

Year.	Imports of Silver £	Exports of Silver £
1865	6,977,000	6,599,000
1866	10,777,000	8,897,000
1867	8,021,000	6,435,000
1868	7,716,000	7,512,000
1869	6,730,000	7,901,000
1870	10,649,000	8,906,000
1871	16,522,000	13,062,000
1872	11,139,000	10,587,000
1873	12,988,000	9,828,000
1874	12,298,000	12,212,000
1875	10,124,000	8,907,000
1876	13,578,200	12,948,300
1877	21,710,800	19,436,700
1878	11,551,500	11,718,000
1879	10,786,800	11,006,100
Total 22 years ..	243,485,300	234,502,100

It will be seen from the preceding table that during the whole of the twenty-two years which cover—and more than cover—the period of the great silver discoveries in America, the total excess of our imports of silver over exports was not more than £8,983,200, being at the rate of £408,327 per annum. In the face of such figures it is absurd to argue, as many do, that the depreciation of silver of recent years is due mainly to the influx of silver from America, such influx taking place by way of England, the world's carrier. Those who reason so go on the old track of ascribing many industrial evils to "over production." It is not, in this case, "over production" but "under consumption" which is the cause of the calamities over which the political philosophers sigh. With silver as with other things: it is not over produced but under consumed, and this for the very simple reason of legislative folly in maintaining heavy shackles on its use, such as "demonetising" the metal for currency purposes, taxing it and even allowing its manufacture to remain at the mercy of antediluvian trade corporations.

It is not uninteresting to observe the directions from which and towards which the great stream of silver passing through this country has rolled along. The current is distinctly shown in the following Tables, which give the imports and exports of silver, both specie and bullion, from and to all countries, according to the official return of the Board of Trade in each of the three years 1877 to 1879 :—

Imports from	1877.	1878	1879
	£	£	£
Russia	—	92,674	—
Germany	13,747,558	3,999,402	784,134
Netherlands	35,257	54,673	8,744
Belgium	72,119	45,614	40,344
France	1,521,300	1,740,657	2,346,584
Portugal	12,375	28,390	213,360
Spain	6,748	13,710	32,806
Gibraltar	27,290	36,362	28,202
Malta	2,612	1,098	2,862
Turkey	3,771	4,958	28,570
Egypt	104,526	42,122	19,829
West Coast of Africa ..	10,905	41,254	61,755
British South Africa ..	1,419	2,042	8,795
British India..	71,570	136,680	126,124
China..	472	1,449	348,908
Australasia	37,572	20,495	114,157
British North America ..	9,325	16,155	11,036
Mexico and South America (except Brazil)	3,352,674	3,519,847	3,581,272
Brazil	41,743	28,041	233,851
United States	2,615,921	1,617,179	2,595,729
Other Countries	35,657	108,743	199,801
Total	21,710,814	11,551,545	10,786,863

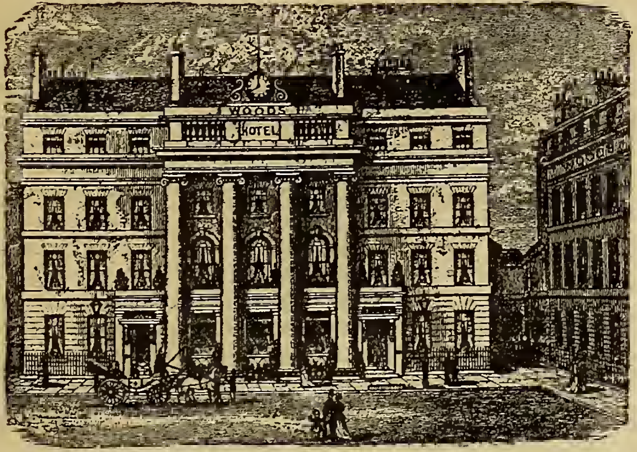
Exports to	1877	1878	1879
	£	£	£
Russia	240	—	1,259
Denmark	4	2,740	125
Germany	64,620	1,473,876	1,723,251
Netherlands	81,108	125,244	134,611
Belgium	20,549	45,842	13,348
France	767,574	2,190,877	722,683
Portugal	11,969	65,718	95,488
Spain	1,553,890	663,242	183,778
Malta	15,600	35,955	—
Egypt	10,277	1,475	13,608
West Coast of Africa ..	91,699	84,758	59,793
British South Africa ..	6,895	410	24,186
British India	14,313,643	4,219,413	6,046,560
China	2,047,685	1,620,756	527,492
Australasia	74,650	53,750	221,539
British North America ..	2,840	3,400	4,100
Mexico and South America (except Brazil)	57,254	39,276	595,021
Brazil	1,600	—	500
United States	297,890	1,082,820	614,320
Other Countries	16,746	8,487	24,432
Total	19,436,733	11,718,039	11,006,094

The preceding tables again show that the depreciation in the value of silver within the last three years cannot have been caused by an extraordinarily large influx from any particular country. It is true we imported 13¾ millions from Germany in 1877, owing to the recoinage effected by the Empire, but the amount fell to four millions in 1878, and to considerably under a million last year. Again the imports from Mexico during the three years averaged barely 3½ millions, while the United States, with the wonderful Nevada Mines, pronounced inexhaustible, sent us but a little over two millions of silver per annum. The latter fact gives a striking proof that what ails us is not "over production," but "under consumption." According to the best estimates, the silver produce of the United States has been, in recent years, about ten millions per annum, of which less than one-third is exported, and more than two-thirds retained for home consumption. There is not a question in America of over-production; but then there is neither taxation nor interference with legitimate trade and manufacture in regard to silver. Thus the great Republic west of the Atlantic is able to consume eight millions worth of silver per annum, while we retain only £800,000. And thus the United States stride forward in the artistic manufacture of silver, while we go backward. At the last Universal Exhibition at Paris, the first prize in silversmiths' work was awarded—and was awarded justly—to a house in New York. It is not so long since England's silver ware was prized as the best made and most artistic all over the world.

Conclusion.—To the question "Is any legislation required to prevent the depreciation of silver?" The answer should be that the remedy lies, not in the making of new laws, but in the repeal of old ones which are obstructive. The Mint should be allowed to coin silver as freely as it does gold; the silversmith should be allowed to manufacture untaxed silver as freely and unhampered as the coppersmith manufactures copper. In a word there should be FREE TRADE IN SILVER.

On Saturday, the 28th ult., at a special sitting of the Maldon borough magistrates, David Claxon and Geo. Claxon, brothers, described as haybinders, were charged with burglariously entering the shop of Mr. Charles Eve, silversmith, and stealing therefrom watches and jewellery to the value of about £200, on the night of Nov. 14 last.

A LONDON HOTEL HOME.



Byfel that, in that sesoun on a day,
In Southwark, at the Tabbard, as I lay,
Redy to wenden on my pilgrimage
To Canterbury with ful devout corage,
At night was come into that hostelrie
Wel nyne and twenty in a companye
Of sondry folk, by aventure i-falle
In felaschipe, and pilgryms were thei alle,
That toward Canterbury wolden ryde.
The chambres and the stables weren wyde,
And wel we weren esud atte beste.

SO did Geoffrey Chaucer introduce his long-famed "Canterbury Tales" to the world towards the end of the fourteenth century. He takes care to tell us that the chambers and the stables were wide, and that they were well used "atte beste." The lines are so pertinent to our subject that we place them at the head of this paper. It has ever been a remarkable trait of British humanity during its civilized ages throughout these islands, that the wayfarer's resting-place—his temporary home, in fact—should alway possess the grand desiderata of comfort and plenty. "Good feasting and plenty of it" was the universal motto of all travellers. Two hundred years after Chaucer, Edmund Spencer, speaking in the "Fairy Queen" of a travelling party of his times, says:—

They spy'd a goodly castle, placed
Foreby a river in a pleasant dale,
Which, choosing for that evening's *hospital*,
They thither marched.

We can readily understand how the "hospitals" of former ages have become—*mutatis mutandis*—the hotels of the nineteenth century. A history of them would be not only curious but pleasant reading. The great lexicographer, Dr. Samuel Johnson, tells us that—"There is nothing which has yet been contrived by man by which so much happiness has been produced as by a good tavern or inn." Shentone, too, writing in the early part of the last century, says:—

Whoe'er has travelled life's dull round,
Where'er his stages may have been,
May sigh to think he still has found
The warmest welcome at an inn.

Shakespeare, also, has many similar allusions, both in his tragedies and his comedies:—

Now spurs the lated traveller apace,
To gain the timely inn.

We think that we have now sufficiently made it plain that from the "hostel" and ancient inn have come the modern hotel; and we are about to introduce one that is largely patronised by the wealthy interests represented by this journal, and has attractive peculiarities of its own; that is, WOODS' HOTEL, Furnival's Inn.

A short distance Citywards from the corner of Gray's Inn Road, Holborn, on the left-hand side, the rambler will come upon a lofty structure of considerable extent in frontage. It consists of a centre and two wings; the centre rises one story from the footway in what is called "rusticated masonry," whilst resting upon it are four Doric columns, supporting a pilastered balcony level with the uppermost story. There are four stories beside the basement. In the projecting part, directly under the columns just mentioned, is a gateway, and that gateway leads into a spacious quadrangular area, flanked by lofty houses right and left. This is Furnival's Inn, and was attached at one time to Lincoln's Inn, as an Inn of Court. An explanatory word or two about these "inns" may be acceptable here whilst mentioning them.

The date of the establishment of houses for the exclusive study of the law seems somewhat obscured by the mists of ages; but the permanent fixture of the old Court of Common Pleas at Westminster appears to have had much to do with it. The historian, Spelman, speaks of it as having happened in the reign of Edward I. (1272-1307). As a gentleman's mansion in those days was called an inn, or hotel, in the sense in which the French use *hôtel* now, it will be readily understood why the houses of the law assumed the former name. They became Inns of Court and of Chancery, as we have them in the present day. Before they became inns, however, they were called "hostels," and had that name for some time. The Inns of Court are four in number, namely, Lincoln's, the Inner Temple, the Middle Temple, and Gray's Inn. To these were added formerly eight Inns of Chancery, namely, Bernard's, Clement's, Clifford's, Furnival's, Lion's, New, Staple's, Symons', and Thavie's. It will not be necessary to go into the history of these ancient establishments for our present object. Furnival's Inn was originally the mansion-house of Sir Thomas Furnival, and afterwards of the Talbots, earls of Shrewsbury. The present buildings are of modern construction, having been put upon the site of the ancient "hostel," and have the accommodation of 100 sets of chambers for barristers and solicitors. We do not think that it is generally known that, although the front portion of Furnival's Inn is in the City of London, all the remainder is beyond the City boundary.

Passing through the gateway, we enter upon a wide, gravelled drive, with chambers upon each side, and reach the quadrangle, in the centre of which is a statue in stone, inscribed HENRY PETO, MDCCCXXXIII. Mr. Peto was the principal owner of the surrounding buildings.

On the north side of the square, and occupying the whole side, stands very boldly and prominently WOOD'S HOTEL. It is an extensive four-storied building, the central portion being ornamented by four Roman-Ionic columns, upon which rests an open balcony, like that over the gateway. A clock, compass-points, and wind-vane rise above that, and give a very imposing appearance to the whole. This hotel was opened more than fifty years ago by Mr. Woods, the then proprietor, in accordance with a plan of his own. But the patronage bestowed upon the hotel soon outgrew the main block, extensive as it was, and permanent accommodation had to be provided by taking in some of the large houses on the eastern, or right-hand side as we enter the square. Even that addition, at times, is not sufficient. The hotel has two entrances, one on the right-hand side, for the general guests, and one on the left-hand side, for the private visitors, such as family parties, etc., who may be staying some time, either for business or pleasure, in the metropolis. The house is at least 250 feet from the thoroughfare of Holborn, and the place is as free from every kind of disturbance as if it was forty miles away in the country. Not a sound is heard save the voices of the inmates and the roll of cabs and carriages drawing up or driving away to break the much-valued quietude of the wearied traveller. This is one of its great attractions, and is often dwelt upon by those living in the house. To say that, within easy walking distance of the Bank of England, the Royal Exchange, and the "heart" of the City, on one side, and the new Law Courts, the British Museum, and the principal theatres on the other, you can enjoy an absence from the ceaseless, deafening roar of the London streets, as perfectly as if you were in a far-off country-house, is what cannot be said of every hotel with which visitors to London are acquainted. The Inns of Court, the Temple, Lincoln's Inn, and Gray's Inn, are all comparatively near; indeed, the two last-named are within a few minutes, Gray's Inn not being more than five away from the hotel-door itself. No disturbance of any kind is permitted, as there is a day-porter and a night-watchman constantly on duty, and the gates are closed at a certain hour at night, being only opened afterwards for the ingress and egress of the dwellers within. With respect to railway facilities, we have to say that the Viaduct Station and the Metropolitan are both near. The former commands the south-east by the London, Chatham, and Dover line, whilst the latter renders Paddington Station very accessible. A cab-ride of a few minutes covers the distance between the hotel and King's Cross, the Midland, and Euston on the north, and the Great Eastern, Cannon-street, and Waterloo in the other directions.

Upon entering the hotel, we are at once introduced to the Coffee-room. This is a lofty, spacious apartment, some 35 feet in length by 25 feet wide and 15 feet high. It is lighted by three large windows; it has a fireplace at each end, and is furnished in a style that no gentleman need wish to excel in his own dining-room. In fact, its very appearance at once impresses the visitor with the certainty of home-comfort throughout every part of the establishment, whilst the attendance here leaves nothing to be desired. The ventilation of this room has been so greatly improved from time to time, that it is stated to be now as perfect as the present knowledge of the art is capable of. The heated air has direct access to the outside, whilst the supply also comes from beyond the walls, thereby producing a continuous balance of atmospheric conditions from hour to hour. Over the doorway is a double-dial clock, one for the Coffee-room, and the other for the Hall beyond. This clock may be safely depended on, as it is set on the synchronising system of Barraud and Lund, by means of an electric time-wire, every sixtieth second of the hour, from the mean-time standard clock of the Royal Observatory, Greenwich. That of itself is a great advantage in a hotel, where the sojourner and his engagements must always move in accord with one another. Only those who have realised how important correct time is on the face of a hotel clock can fully appreciate being able to look at that of Greenwich at all hours of the day, and to set their own watches by it. Moving a little further on, we reach the clerk's office, and there we find a telephone, which places the house in free communication with everything, either in the way of business or pleasure, in the metropolis. Stalls can be ordered at the opera, boxes at theatres, and carriages; your broker or banker can be whispered to, or a great physician can be summoned instantaneously! We have spoken of the hotel having a right-hand and left-hand entrance. We have now to add that the passages leading from these entrances enclose an ample-windowed room, for the Service Department and Bar. Here all inquiries are made, all orders are given, and all letters and telegrams are received, and "tabled" for delivery to their respective owners. We turn to the right on our way and pass towards the Smoking-room, which, like the Coffee-room, is well and cosily furnished, and has its own attendant. Before reaching there, however, we come upon what appears to us as a very convenient novelty in hotel management. Upon a door we see painted, "Cigar Stock-room." We enter, and find that the interior is in accordance with the name. The walls are faced with mahogany cabinet work in the form of enclosed shelves, laden with boxes of cigars of every choice and [illegible] brand known in the smoking world. One would naturally say that such an army of boxes of cigars would hardly be required for the wants of the hotel. Nor is it. The supply of what we were shown was for the regular guests of the hotel; those who come to London two, three, or four times a year, and oftener. They know the quality of the brands kept in the house, and they either take home with them, or have sent down from time to time what longthened experience has told them can be depended on.

Let us look in upon "The Ladies' Wing." Here we find a Ladies' Coffee-room and Drawing-room, where they may live, sing, and play music in company with their husbands and children, or their fathers and brothers, as comfortably as if they were by their own firesides. Female attendants are specially attached to this wing, and every means are adopted to render it homely in the highest degree. This part of the hotel is amply supplied with newspapers, guides, and the best current literature of the day for the amusement of its occupants.

In this Ladies' Wing, we must mention that there are twelve additional suites of rooms, which can be adapted, if necessary, for family purposes. There are Bedrooms and Sitting-rooms communicating with each other, and Dressing-rooms adjacent. Whilst we are at this point we may mention that there are Bath-rooms available when called for, and accommodation can also be had for the personal servants of visitors. This part of the hotel presents the appearance of being in a very complete state, indeed.

Upon leaving the Ladies' Wing, we went into the Reading-room—a most capacious apartment immediately over the principal Coffee-room, and of the same dimensions. Here is extensive accommodation—and luxurious accommodation, too—for a large number of persons. It is more than usually well lighted, both by windows by day and great gas chandeliers by night. There are lounges for the readers, and writing-tables and single desks for epistolary work of all kinds. There are maps, guides, directories, magazines, newspapers, etc., for all ordinary requirements; even a copying press has not been omitted! This apartment, we were informed, was once the "Hall" of Furnival's Inn.

The Bedrooms are on a scale commensurate with those portions of the house which we have already described; and it may be as well to add, for the satisfaction of the nervous in London houses, that there are no fewer than *four stone-built staircases*, all and each available to everyone sleeping in the house. In addition to these there is a porter on duty all night in the house, and the watchman of the Inn at his post outside, holding constant intercourse with the police constables on the beat. There are one hundred and thirty rooms in all, yet, so admirably organized and so well in hand is the service, that immediate attendance can be readily obtained in any part of the establishment at any time.

The Kitchen department of every house forms an important element in modern life; and especially is this so in the club and the hotel. Indeed, unless in very large private houses, people count with confidence upon enjoying the products of high culinary skill at both of the places named. We can hardly take upon ourselves personally to offer an opinion upon the question, but if that of the "educated" in the art of dining is to be relied upon, there will be no reason to complain of where we are now speaking about.

It has been laid down as an indisputable law that a man who has a sensible value of his health, and desires to keep all his energies in pristine order, mind as well as body, should enjoy his meals where neither disturbance nor vexation can enter. By way of illustration it is recorded that a French general commanding troops in the East was one day waited upon by a deputation of native magnates just as he was about to sit down to dinner. He ordered his aide-de-camp to receive them as politely as possible, but to solemnly impress them with the fact that it was one of the sternest precepts of the Christian religion, from which no earthly consideration ever induced him to depart, never to attend to business of any kind, save life or death, at dinner time. The members of the deputation in taking their leave raised their hands in wondrous admiration at the superior piety of the commandant.

The distance over the sea to which the fame of these first-class hotels go, and where they establish a reputation, is not the least remarkable feature of nineteenth century existence. In looking over American newspapers we came upon an article under the title of "The Hotels of London" in the *Hotel World* of Chicago, the great and widely-known metropolis of the Western States, some 1,300 miles beyond New York. After describing several of the principal houses, the writer goes on :—

"But of the London hotels there are none that I take more pleasure and confidence in recommending than Woods' Hotel, in Furnival's Inn, which is entered through a portal from High Holborn. To one seeking the comfort of repose in the centre of London this hotel offers unrivalled inducements. It is frequented by both European and American travellers of the most refined taste and highest social position, who are desirous of securing the greatest luxury and comfort without the ostentation of the larger hotels of the West End.

"The buildings and surroundings are characteristically English, yellow brick, with the front of the hotel facing Furnival's Inn, and a square or courtyard, artistically ornamented with Corinthian pillars, separating it from the streets.

"The great omnibus traffic between the City and West End passes along High Holborn. Cabs are also procured at any time to the West End, places of amusement, or any of the principal sights for 25 cents for one or two persons.

"The *cuisine* of this hotel is especially adapted, both in quality, quantity, and the variety of dishes, to please the most fastidious disciple of Epicurus. The wines are of the choicest foreign brands, and have held the reputation during the last thirty years of being the best to be procured in London. *The attendance is good, and the tariff is moderate.* The rooms are single or *en suite*, and of different prices and styles to suit the taste and purses of the various occupants. The management is thoroughly systematic."

It would be difficult for us to award higher praise than that, even if praise were our object, which it is not. We can, however, truthfully endorse every word of our trans-Atlantic cousin. When an American writer and traveller from the land of perfect hotel-keeping speaks so highly of a London hotel, his word may be taken that he is sufficiently conversant with his subject. We can only add that in Woods' Hotel there is nothing "grand," nothing startling anywhere, but on all sides the visitor is made to feel that he is surrounded by all the ease and comfort of a first-class hotel home.

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BILLS OF SALE.

Greaves, William, 8, Spring Garden Terrace, Barrack Road, Newcastle, watchmaker and cowkeeper. April 27. £17, &c. Given to the North Eastern Loan, &c., Company.

Harmston, George, High Street, Monson Street, Lincoln, watchmaker and jeweller. April 27. £28, &c. Given to the Lincolnshire Advance Bank.

Medes, John Sidney, 12, Paddock Terrace, Victoria Street, Rochester, dealer in jewellery, cigars, &c. April 27. £100, &c. Given to Sampson Burford.

Tucker, David, 22, Bridge Street, Carmarthen, watchmaker. May 2. £19, &c. Given to Henry Barnett.

Jeffery, Frederick, 61, Tavistock Street, Stoke, Devon, watchmaker. May 3. £28 5s., &c. Given to John T. Smith.

Forrest, William, 2, Findon Terrace, Crouch Hill, Hornsey, and 52, Clerkenwell Road, jeweller. May 4. £80, fur. charge. Given to Charles Hay.

Watchorn, John, 59, Stanley Cottages, Alhert Road, Peckham, optician. May 5. £25 5s., &c. Given to William Hollingsworth.

Edwardson, Frederick, 36, Lavender Road, Clapham Junction, watch and clock maker. May 6. £9, &c. Given to Thomas Fairhead.

Alston, Edward, 133, Market Street, Chorley, Lancashire, pawnbroker, clothier, jeweller, &c. May 6. £1,550 abs. sale. Given to David Tullis and another.

Bayley, Henry, 35, Prospect Villas, Cobden Park, Old Radford, Notts, agent and jeweller. May 6. £21, &c. Given to William Miller.

Collyer, John, Church Street, Handsworth, Staffs, late jewellers' factor. May 6. Set. tr. fr. wf. Given to James D. Daly and another.

Dovey, Herbert James, 6, Blatchington Road, Hove, Sussex, clock, &c., maker, jeweller, and tobacconist. May 7. Given to John W. Sibley.

Fletcher, Charles, 73, Church Street, Attercliffe, Yorks, watchmaker. May 7. £7 10s., &c. Given to John Jacobs.

Kaiser, Richard, 135, Cowbridge Road, Canton, Cardiff, watchmaker, tobacconist, &c. May 7. £8, &c. Given to Isaac Samuel.

Saalmans, Henry, 46, St. Thomas's Buildings, and 13, Bodley Street, Liverpool, watchmaker. May 7. £14. Given to the Imperial Advance Bank.

Wulff, Henry August William, 54, Newhall Hill, Birmingham, watchmaker, &c. May 9. £21, &c. Given to the Midland Credit, &c., Company.

Willis, George, 4, Market Street, Northwich, Cheshire, watchmaker, &c. May 10. Deed of gift to son. Given to George F. Willis.

Bragg, William Eaton, 3, Lee Crescent, and 9, Ellis Street, Birmingham, electro plater. May 11. £70. Given to Samuel Lawson.

Kew, Frederick, 2, Back of 39, Ellison Street, Sheffield, silversmith. May 11. £6 15, &c. Given to Joseph Cooke.

Norris, George Alfred, 13, New Charles Street, Goswell Road, optician. May 11. £12. Given to the Bloomsbury Adv., &c., Company.

Mindry, Frederick Robert, 4, Hanover Street, Portsea, electro plater. May 13. £7. Given to Samuel Melville and others.

Rostill, Henry, 154, St. Vincent Street, Ladywood, Birmingham, silver plate worker and grocer. May 14. £10 10s., &c. Given to Benjamin Abrahams.

Tierney, James, Kirkgate, Settle, Yorks, watch dealer and jeweller. May 14. £200. Given to Thomas Leeming.

Grisewood, Robert, corner of Nook Street, Guard Street, and 12, Jane Street, Workington, Cumberland, pawnbroker, jeweller, &c. May 16. £186 13s., &c. Given to Isidor Summerfield.

Hirt, Titus, 12, Sherwood Crescent, Kensal Road, Westbourne Park, watch, &c., maker. May 17. £18. Given to the Bloomsbury Adv., &c., Co.

Cohen, Joseph, 25, Northampton Square, Clerkenwell, dealer in jewellery. May 17. £12, &c. Given to Alfred D. Thornton and another.

Cohen, Mylius, trading as L. Behn & Co., 343, Kentish Town Road. May 18. £150.

Hannaford, Theodore, 54, Vyse Street, Hockley, Birmingham, beer retailer, tobacconist, and jeweller. May 19. £35, &c. Given to Walter Carter.

Bath, James Long, 4, Cleveland Terrace, Bath, watchmaker. May 20. £100. Given to Henry E. Force.

Burgess, Walter James, 124, Long Acre, and 1, Mercer Street, Long Acre, jeweller, silversmith, pawnhroker, &c. May 20. £400, &c. Given to the Union Deposit Bank.

England, Edward Ernest, 281, High Street, Camden Town, watchmaker and jeweller. May 21. £125, &c. Given to Henry Harrison.

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